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CUBAN DEVELOPMENT.

The completion of the first part of the Havana trolley system, and the return to this city of some of those engaged largely in the enterprise, calls attention again to the opportunities in that field. From our own knowledge of that part of the world, we are inclined to consider such opportunities as considerable. One of the New York journals has a correspondent on the ground who in referring to the railway and lighting work there, characterizes it as of doubtful desirability, and remarks as follows: "Only one electric lighting and one gas company have so far appeared. Both are old companies. Neither owns a monopoly, and both render indifferent service. Since it is probably as good as the people can afford to pay for, there would be no present temptation for American capital to invest in such enterprises. The franchise injunction does not apply to them or to various other concessions essentially local, and which the military will doubtless always permit municipal authority to regulate. This applies to local concessions all over Cuba, which in its present development hardly promise enough return to make them worth seeking by Americans."

This may be more or less a fair statement of affairs at the moment, but it is to be hoped and believed that Cuba is to develop under our flag and then under her own, so that electric railways and town lighting plants will become numerous. But it is when one looks at the agricultural, manufacturing and mining industries of Cuba that the best chance for American electrical apparatus presents itself; and if we here neglect to meet the new demand of more prosperous times, our European friends will not.

ELECTRICAL TRANSMISSION IN ENGLAND.

Some very interesting and promising schemes have lately been put forward in England for the long distance transmission of electrical energy in bulk, on a plan that has long since become familiar in this country as well as in some parts of Continental Europe. For the life of us we cannot see what the objections are to such work, in England, where cheap power must become more and more a matter of national existence; but as our London correspondent has lately detailed, a most virulent opposition is being exercised against the project, from various municipal authorities who see in it the undermining of their power, prestige and perquisites. If England allows this kind of thwarting to stand in the way of her progress, she will not merely have to take sound lickings from the Boers until she overmasters them, but she will have to take worse punishment from more powerful foes. England's voluntary decadence would be a disaster for the world, just as her victories are those of equality and progress, and it is for her to make the right choice in just such emergencies as this. It should be understood that these English transmission companies ask no monopoly. All that they seek is the permission to sell current cheaply to any customer they can reach, regardless of his previous condition of servitude to a petty municipal plant; but they are apparently to be denied this opportunity to cheapen English goods in the markets of the world. If England doesn't care, we don't. It is a good thing for us to have these Little Englanders ruling the roost.

TROLLEYS AND COMMUTERS.

It is reported from Chicago that the entire suburban train service there of the Pennsylvania Railroad will probably be abandoned, the local officers having recommended that all such trains with the ex-

ception of one each way, morning and evening, be taken off. The reason assigned for this is that of trolley competition. At least that is confessed to be the principal cause, and we can hardly imagine any other in a growing city like Chicago.

There seems little doubt as to the truth of the report, which is but another evidence as to the notoriously serious effect that the trolley has had on "commuter" service wherever the conditions have permitted rivalry. The fact that the public prefers the trolley and that the Pennsylvania service is losing money, would indicate that nobody will sustain a great hardship by the withdrawal of the trains. But now that they are to be taken off, their removal should act as an incentive to the improvement of the trolley service in various ways. The added traffic will warrant it and render the trolley even more profitable than now.

Engineering and Invention.

In his recent excellent address before the Association of Students of the English Institution of Civil Engineers, Sir William Henry Preece made some admirable remarks on the dignity, responsibility and opportunities of the profession that must have been highly stimulating to his auditors. His family tree of engineering must also have set them thinking as to the rapid differentiation of expertness in these days, with its greater chance for any specific quality of mind, yet with its peril of narrowness. Perhaps the most pregnant remark he made was that in which he dwelt on the progress of invention at a compound rate. "It took 3000 years to mature the alphabet. It has taken 450 years to perfect printing, but 60 years in our days have matured telegraphy and photography, and only 60 months have been sufficient to apply Röntgen rays to assist the physician to apply his gentle art to restore to health the maimed and wounded."

This is ingenious, but risky reasoning. At such a rate, we ought soon to have startling, revolutionary inventions every fifteen minutes, so that instead of one bad quarter of an hour in the day there would be 96. A kindly Providence forbids such things. Inventions not only have to be made, but they have to be digested and assimilated, and fortunately that takes time. Here in America we are always capitalizing the invention that is to be made to-morrow. In England they are just beginning to capitalize the trolley when we are taking to the conduit; and thus it runs all along the line. We would like to ask Sir William what great electrical invention has been made not in the last fifteen minutes, but in the last fifteen months?

But that is after all an aside, and when a man who has done so much for the practical engineering arts stands up to laud them, we are heartily with him. It is true as he says, that "the engineer is not only a benefactor to his race but he is a necessity of the age." And more, without him this age of long peaces and short wars, of greater comfort, happiness and general welfare would not be. As to the general education of the engineer, the opinion of Sir William is in line with the most recent thought. The first foundation, he says, is clearly a broad, solid, general education, not specialized in any way until the pupil has reached a stage where he can work and think for himself. The late Franklin L. Pope, who was a strong believer in this dogma, on one occasion pointed out to the writer that every member of the technical staff of a certain large manufacturing company had been graduated from an academic college course before taking up technical study. As to the rôle of mathematics in the education of an engineer, Sir William calls it the shorthand of thought and the purest form of logic; this, together with "experiment, the handmaid of observation, measurement, the instigator of accuracy and precision, and reasoning, the organ of common sense," are denominated "the tools that shape the store of knowledge which memory brings to his help when he is called upon to practice what has been learned."

Wanted—Reactance.

That one thing dreaded by pioneers in alternating-current engineering—self-inductance—has become not only desirable in many cases of power transmission, but actually difficult to obtain in sufficient quantities without going to considerable expense and entailing added losses. Those who have striven by every practicable means to cut down the reactance of machines, lines and transformers will find it hard to believe that in some instances the overload protection, the regulation and the general flexibility which that elastic quality, reactance, gives in a complex alternating-current system, are abandoned on account of the difficulty of getting the needed self-induction. Reactance is, as is well known, of value on lines supplying synchronous machinery where leading currents can be introduced to swing the reactive drop around into such a phase relation as to make it increase the impressed e. m. f., thus giving a simple means of obtaining regulation. It is specially valuable in lines supplying rotary converters, where it allows the direct voltage of the rotary to be varied independently of the pressure of the generator supplying it. With sufficient reactance in the circuit, the voltage of a converter can be varied by the same simple automatic means used on generators, viz., a compound winding. Without reactance, the series field coils of a compound-wound rotary are absolutely ineffective.

With overhead transmission lines a serviceable amount of reactance can be obtained by keeping the wires of the circuit well apart from each other on the cross arms, especially if the amount of current transmitted and the distance are considerable. The regulation so obtained does not give individual regulation to the several machines at the receiving end of the line. The same is true of the reactance of the generators themselves. With underground lines it is impossible to obtain reactance by spreading the conductors, as this would set up e. m. fs. in the lead sheathing practically equal to the reactive drop obtained. In the case of converters it would at first sight appear that the step-down transformers supplying them would be just the place to obtain the needed self-induction, especially if each converter were independently supplied by its own group of transformers. Incredible as it may seem to those who have not considered it before, and who are accustomed to the difficulties of getting sufficiently close regulation in lighting transformers, it is impossible to obtain in the type of transformers which have come into general use for rotary-converter work, the necessary amount of magnetic leakage to give the reactance needed for a reasonable range of regulation. The transformers are invariably of the shell type with flat "pancake" coils, several of which must be connected in parallel with each other for the low-tension secondary. If the attempt is made to bunch the primary layers together and not interleave them with secondary layers, those layers of the secondary which come nearest the primary bunch will get a higher voltage than the other secondary layers and will take the whole load, or in extreme cases send a reversed current through those layers furthest from the primary. This action, which is due to the same magnetic leakage which is sought for other purposes, will promptly burn out the overloaded secondary paths.

Between the transformers and the rotary there is an opportunity to obtain a working reactance in the case of large powers and particularly with the low voltages used in lighting work. By spreading the wires running from the transformers to the rotary a wide distance apart, considerable reactance can be obtained at this point. Beyond this there is only the reactance of the rotary armature windings themselves, which can be made considerable by designing the machine for strong armature reaction. In many cases, however, it becomes necessary to insert serially in the circuit coils wound on iron cores increasing the cost as well as both the iron and copper losses although not the no-load losses. This addition to the cost and losses

solely to obtain reactance seems unnecessary, and no doubt means will be found to avoid it.

MATTHIESSEN'S STANDARD.

Ever since Dr. Matthiessen undertook his classical researches upon the conductivity of copper wires in 1862, and created a standard of conductivity, electricians have been trying to determine what Matthiessen's standard is, and there has been nearly as much dissension in the world of applied electricity over the exact value of this standard as there has been in the political world of the United States in regard to the relative standards of gold and silver. In this country the American Institute of Electrical Engineers considered the matter in 1889, and appointed a committee to report upon the subject. The report of that committee was published in the Institute transactions of 1893, and laid bare the result of its lucubrations upon the subject of Matthiessen's standard; while the tables based upon this report are still the standard tables of the A. I. E. E. and are generally used throughout the country. A similar action has recently been taken in England in conjunction with the British Institution of Electrical Engineers, and this committee has recently brought forth the result of its lucubrations in the *Journal* of the Institution of Electrical Engineers for January, 1900, p. 169. Several interesting conclusions may be drawn from this report.

In the first place it is sad to see engineers in Great Britain clinging to the Fahrenheit scale of temperature. All the results have been reduced to a standard temperature of 60° F., which corresponds to 15.555° on the Centigrade scale. It is true that in this country also the antiquated Fahrenheit scale is in general use, but electrical engineers at least have succeeded in breaking through the thrall and most electrical and chemical measurements are here made by the Centigrade scale. In the second place it is curious to observe that the committee should first determine what is to be accepted as Matthiessen's standard, stating it in terms of the meter-gramme at 60° F., and then give data for standard tables in terms of the "cubic inch," "cubic foot," "inch-grain," "mile," "yard" and "mil-foot." The area of the wires appears in these formulæ in "square inches" and in "square miles." It is a matter for congratulation that acres, rods, poles and perches have been omitted. The standard weight of copper is taken as 555 pounds (avoirdupois, presumably, but not stated) at a temperature of 60° F. This number suggests some numeric in the Book of Revelations, but is the one thing in the report that is easy to remember.

Apart from the archaic nature of the units in which the results of the committee are expressed, the report is valuable and possesses certain novel and interesting features. For the first time a definition is given of hard copper; namely, copper which breaks before it has elongated 1 per cent. Unfortunately soft copper is not in like manner defined. Secondly, the commercial coefficient of resistivity in copper is accepted as 0.238 per cent. per degree F., reference being made to the Clark, Forde and Taylor pamphlet of Feb. 20, 1899, as the basis for this result. Reference to that pamphlet shows that the temperature coefficient of resistivity between 32° F. and 100° F. was found, by measurements with commercial copper wires, to be approximately linear, and was approximately 0.238 per cent. per degree Fahrenheit, based upon the resistivity at 32° F. as standard. While with reference to 60° F. as standard, the temperature coefficient is approximately 0.225. It is evident therefore that the report involves two standard temperatures; namely, 60° F. for resistance and 32° F. for the resistivity coefficient, although this duality is not adequately pointed out. It is interesting to observe, however, that our British cousins consider that for commercial purposes a simple linear relation of resistivity to temperature can be adopted, and one which represents a simple increase of resistivity by 0.4284 per cent. per degree Cent. based upon the resistivity at 0° C. which corresponds to a resisitivity coefficient of 0.4 per cent. based upon the resistivity at 16.57° C. The coefficient commonly adopted in this country is 0.4 per cent. based upon the resistivity at 25° Centigrade.

The next interesting feature is the adoption in the report of a resolution to the effect that when stranded wires are used, the wires are to be considered as though completely insulated from each other, or as coated with an infinitesimally thin insulating layer. It follows from this that the resistance of the strand is the joint resistances of all of the independent wires and the lengths of these wires are computed in standard tables on the basis of a lay of twenty times the pitch diameter. The weight, length and resistance are all considered as those actually due to an association of wires having the length necessary for this lay. This seems to be a very sensible conclusion and one that has never yet been generally decided upon. Coefficients are given for the resistance of strands of various numbers of wires in terms of the resistance of each wire. Another interesting feature is an allowance of 2 per cent. variation both in resistance and in weight for accidental variations in manufacture, with 1 per cent. of extra increase in resistance based upon the diameter for tinned copper between Nos. 22 and 12 standard gauges, respectively.

Taking the report as a whole, it is eminently satisfactory in regard to the practical values adopted, and we trust that it may form the basis for future international agreement when reduced to more convenient engineering units and notation. In spite of the fact that the ratio of resistivity in Matthiessen's hard copper to Matthiessen's soft copper is taken as 1.0201, whereas the American Institute took this ratio from some of Matthiessen's own results at 1.0226; also that the specific gravity of copper has been taken at 8.912 instead of 8.89 as deduced from some of Matthiessen's results, yet the actual resistances of copper wires as based upon the report of the British Committee is practically the same as that adopted by the A. I. E. E. Thus from the A. I. E. E. committee report, the soft copper meter-gramme is deduced to be 0.15045 international ohm at 15.55° C. or 60° F., while the British report makes it 0.150822, or about one-quarter of one per cent. higher. It is evident that when we depart from abstractions and compare actual figures there is not likely to be any serious practical discrepancy between British and American wire tables. At the same time it seems desirable that there should be a general agreement among electricians all over the world as to what is the resistance of standard commercial copper wire at any given temperature in terms of its length and mass.

The results of the A. I. E. E. prepared in 1893 involve Matthiessen's coefficient of temperature for resistivity which are no longer generally regarded as correct, although the correction is practically trivial in amount. The results of the British committee just published are expressed in units that are unfit for world-wide adoption. It would be desirable for the Electrical Congress which is to meet this year at Paris to adopt a standard resistivity for soft copper wire in terms of a meter-gramme at 0° C. and also a commercial linear coefficient of increase in resistivity, say 0.4284 per cent., based on the standard at 0° Cent., embodying at the same time the resolutions concerning stranding of wire and other practical data found in the British report. By this means all the wire tables in the civilized world would be brought into agreement, after allowance had been made for the particular gauge used, and if the foot-grain, Fahrenheit-degree, square-inch and square-mile system should unfortunately continue to be officially used in the United States and Great Britain, the results so tabulated would still be brought into conformity with existing international standards in the decimal system.

Independent Telephone Personnel and Finances.

The Telephone, Telegraph & Cable Company of America in making its assessment of $2.50 per share to meet the cost of recent and prospective acquisitions of independent telephone property, gives the following list of its directors: Harrison E. Gawtry, New York; Charles W. Morse, New York; William H. Gelshenen, New York; John Jacob Astor, New York; Henry R. Wilson, New York; Frank Tilford, New York; George Crocker, New York; Daniel O'Day, New York; Martin Maloney, New York; Oakes Ames, Boston; Z. S. Holbrook, Boston; Charles E. Adams, Boston; Joseph B. McCall, Philadelphia; Hugh J. McGowan, Indianapolis; J. Henry Cochran, Williamsport; James E. Hays, New York; William J. Latta, Philadelphia, and Francis M. Jencks, New York. Of this board President Latta says: "These names will indicate that the policy of the company will be one of conservative management, with a vigorous prosecution and development of the various phases of its business which it is authorized to conduct under its charter."

Of the acquisition of the Erie Telegraph & Telephone Company, an increase in the capital stock of which from $5,000,000 to $15,000,000 was recently authorized, the circular says: The company has recently acquired a controlling interest in the Erie Telegraph & Telephone Company, which possesses practically all of the telephone business of seven states—North and South Dakota, Minnesota, Wisconsin, Texas, Arkansas and Michigan—as well as the city of Cleveland, Ohio. This is a most important acquisition, constituting the foundation upon which can be built an extensive system of long distance lines, and insuring the linking together of cities now and hereafter to be occupied into one comprehensive whole.

The rapid development of the company is shown by the statement that at the present time it is controlling the operation of more than 115,000 telephones in the country, with, the circular states, "very profitable results."

The authorized capital stock of the company is $30,000,000. It is, however, an assessable and not a full paid issue. Upon the stock at present $5 has been paid, and an assessment of $2.50 additional, payable May 1, has now been levied. The rearrangement of the finances contemplates the issuance of full paid non-assessable shares, but the details of the change are not made public. Of this feature the circular says: It has been thought by many of our stockholders that the rapid development of our company might make necessary the immediate calling in of the balance of our unpaid capital, but it is believed that this can be substantially avoided by the proposition now under consideration, without at the same time endangering the great future of the company. This plan will also give our present stockholders the direct financial benefit accruing to them from the absorption of the Erie Telegraph & Telephone Company.

Arrangements have been made to list the stock of the Telephone, Telegraph & Cable Company of America in Philadelphia.

The Erie Telephone Deal and President C. J. Glidden's Position.

A great deal of curiosity has been felt as to the position of relationship of President C. J. Glidden, of the Erie system, towards its new anti-Bell owners, he being one of the oldest managers in the Bell ranks. It is therefore interesting to note that in a recent communication to President William J. Latta, of the Telephone, Telegraph & Cable Company of America, Mr. Glidden says: "I understand that it is the wish of your board of management that I remain as president of the companies comprising the Erie telephone system and continue to push forward the work of extension authorized by the board of directors giving the seceral interests the benefit of my services and experience and still further building up the enterprise and increasing the earnings of the company.

"I will remain until Aug. 29, 1902, or resign any time at your request, conditional that the same policy now in force is to be pursued and that I will not be required to carry into effect a policy that will in any way be antagonistic to the contracts existing between the American Bell Telephone Company and the several sub-companies controlled by the Erie Telegraph & Telephone Company.

"I congratulate you upon having secured the control of the best telephone property in the world, thoroughly organized and officered by a force of employees that have the interests and success of the enterprise at heart. I predict a decidedly bright future for the Erie and look forward to see the property rapidly increase in value and its securities command a very high price in the market."

It is said that before the New York and Philadelphia syndicate purchased the 50,000 shares of Erie stock they were permitted to make a most thorough examination of the books of the company, employing a firm of New York expert accountants whose reports were of a most flattering character. The legal examination was made by one of the leading lawyers of Philadelphia and passed upon with much favorable comment. Erie will be on a 6 per cent. dividend basis commencing with a dividend payable in July. The new owners will offer the minority interest $120 per share for their stock, payable in their 5 per cent. thirty-year bonds secured by the Erie stock.

The holder of the bonds of the Telephone, Telegraph & Cable Company will have the guarantee of that company whose capital when fully paid will be $30,000,000, and in addition to this Erie stock as collateral. The New York Company guarantees a dividend equivalent to 6 per cent. for thirty years and the payment of the bond. Failing to keep their obligation, Erie stockholders will have their own stock returned. This should enhance the value of all Erie underlying securities.

Organizing the New York Underground Railway's Working Force.

At the meeting of the Rapid Transit Railroad Commission in New York Friday of last week a plan was adopted for the organization of the force which will be needed to supervise the work of construction of the underground railway. It was decided that the working force which Chief Engineer Parsons would need shall consist of one deputy chief engineer, six division engineers, three general inspectors, one private secretary, one auditor and one photographer, all belonging to the class of employees exempt from civil service competition, as the commission believes, and a senior assistant engineer, assistant engineers, transit men, levelers, rodmen, axemen, inspectors of steel, cement testers, inspectors of steel construction, inspectors of masonry, accountants, stenographers and messengers, all to come from civil service lists. A deputy chief engineer was appointed at the previous meeting and he is already preparing the new offices of the engineering department at 320 Broadway. At the last meeting the board appointed Albert Carr as engineer of the first division (embracing that part of the road reaching from the Post Office to Forty-second Street) at a salary of $4500 a year.

Independent Telephony in Massachusetts.

Officials of Massachusetts Telephone & Telegraph Company state that all subscribers of the company in the city of Boston will be enabled to converse over the system next fall. The approach of spring will permit the contractors to push the work of laying conduits, which during the winter months has been slow and tedious. The company now has one mile of conduits laid and ready for service. It has also wire connections with Springfield, Taunton, Brockton and other cities as well as towns in that section of the state. Within ten days a temporary central office will be opened at the headquarters of the company on Congress Street and service will be inaugurated between the forty subscribers on the line of conduits now laid. The service will be both local and long distance.

The Massachusetts Company has a plant in operation at Stoughton, Mass., with 100 subscribers. In Waltham the company has just closed negotiations for its central station and service in that city will be in operation very shortly. Between 5000 and 6000 subscribers have thus far been secured in Boston.

Telephone Tunnel Under the Milwaukee River.

Permission has been secured from the Secretary of War and from the Board of Public Works of Milwaukee by the Wisconsin Telephone Company to build a tunnel under and across the Milwaukee River at the foot of Mason Street. This, together with several other improvements contemplated, will cost about $500,000, and when the work is completed the exchange in the city will be one of the best of the Erie system. The work of the tunnel has been planned by P. G. Reynolds, general superintendent of construction, and John Harper, engineer, who established headquarters in Milwaukee last May. The contract for the work will be let within the next few weeks.

Wallingford, Conn., Municipal Electric Lighting Plant.

BY THOMAS C. PERKINS.

THE Borough of Wallingford, Conn., with a population of 10,000, has recently put in operation a municipal electric lighting plant, some features of which are of interest with respect to modern central station design as applied to small plants. In laying out the generating station the main object in view was not so much to obtain the highest economy in steam consumption

FIG. 1.—EXTERIOR VIEW OF WALLINGFORD MUNICIPAL PLANT.

on a maximum load as to securing a reliable and serviceable equipment embodying all the latest improvements applicable to a station of this size that could be operated with a minimum amount of labor and repairs with a fair average of economy.

The power plant is located about three-quarters of a mile from the business centre of Wallingford on the banks of the Community Lake, thus securing ample water at all times for boiler feeding, as well as for condensing purposes.

As it was desirable from points of economy and simplicity that not only arc lights for the streets but incandescent lighting for commercial use should be furnished from one type of generating apparatus, at the same time taking into consideration the amount of territory to be served, the selection was made in favor of the alternating low-frequency single-phase system with series enclosed alternating-current arc lamps for street lighting.

The power station consists of a brick and iron building with monitors, with tar and gravel roofing, divided into three sections, viz.; boiler room, engine room and superintendent's office, store room, etc. Its outside dimensions are 104 feet by 45 feet, corresponding to one-half of the ultimate size of the plant. At such time as the increased business warrants the doubling of the power station, a permanent brick chimney will be built on the opposite side of the building from the present temporary iron chimney, midway between the two batteries of boilers.

In the boiler house are located two 72 inch by 19½ feet horizontal return tubular boilers with flush fronts, furnished by P. Delaney & Co., of Newburgh, N. Y., space being left for the addition of a third boiler of the same size, when required.

In the engine room are located two simple engines of 125-hp and 300-hp each, respectively, of the Corliss self-oiling type, furnished by the Harrisburg, Pa., Foundray and Machine Works. These engines are operated in connection with a twin vertical air pump and condenser furnished by the Warren Steam Pump Company. Steam is taken from each boiler by means of a heavy bend to a main steam header 10 inches in diameter, which extends across the wall at the back of the boiler room. This header is dripped back into the boilers, and being on a level considerably above them acts not only as a distributing main but as a separator as well. Steam is taken from this header by means of a heavy bend of ample radius to each engine. All high-pressure piping, the valves—which are of the Chapman make with outside screw and yoke, are adapted for 175 pounds pressure. The main and auxiliary heaters are of the American type, and the feed piping is arranged so that the boilers can be supplied with water either from the lake or from the city service, by a duplex boiler feed pump or a Hancock inspirator, at will.

The generators, which are belted and of 75-kw and 150-kw each, respectively, are of the single-phase low frequency 2000 volt type, and were furnished by the Fort Wayne Electric Works. Room is provided in the station and the piping arranged for the installation of an additional engine, which will be of tandem type, a condenser and a 150-kw alternator, when necessary.

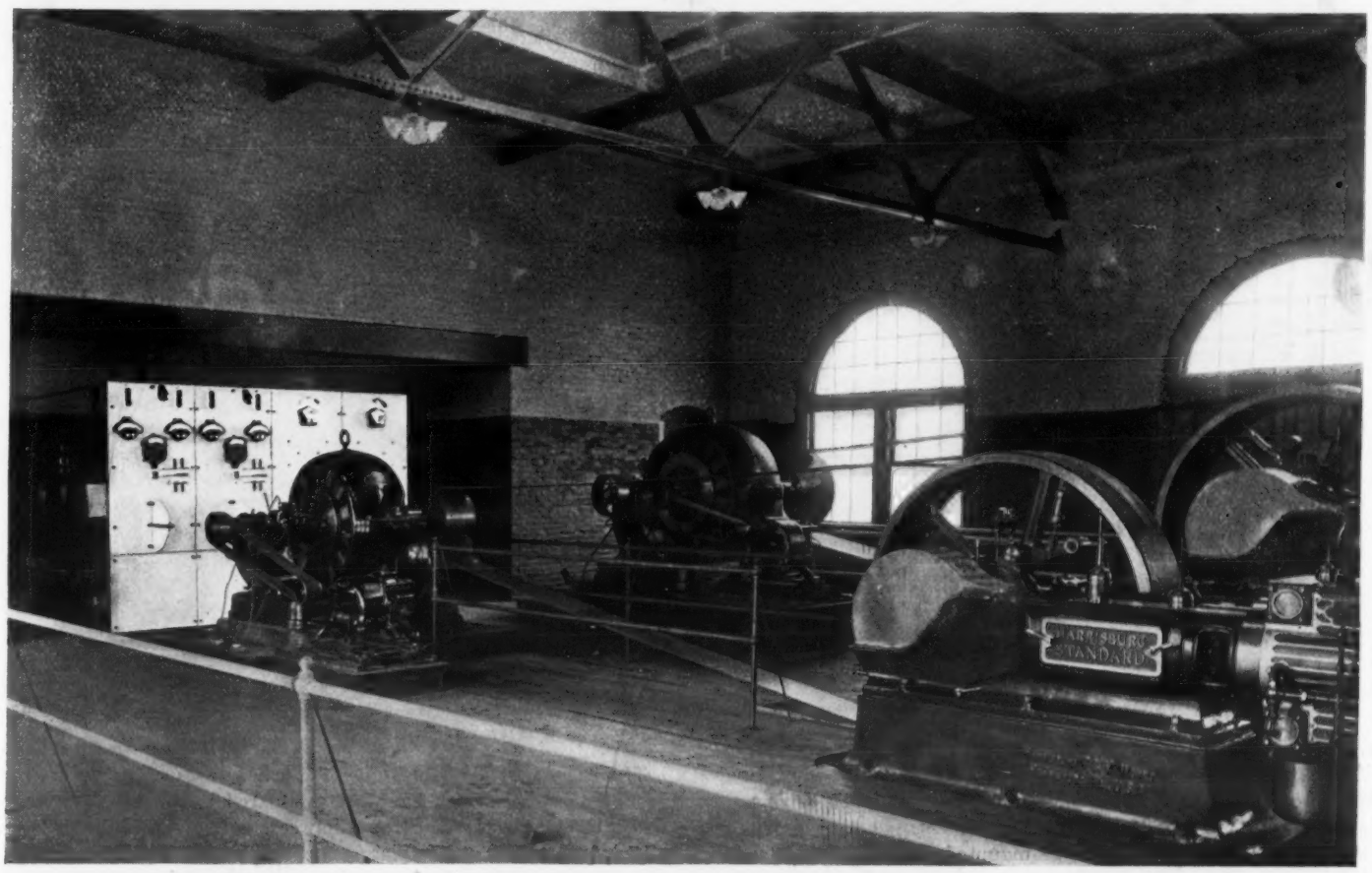

FIG. 2.—INTERIOR OF WALLINGFORD MUNICIPAL PLANT.

The switchboard, at present, consists of two standard single phase alternating-current generator panels furnished by the General Electric Company, and two arc-circuit panels with plug switches. The line circuits leading from the switchboard are first carried up a brick well at the rear of the switchboard and thence out over the roof of the power station, thus reducing the possibility of fire from short circuits or crosses to a minimum.

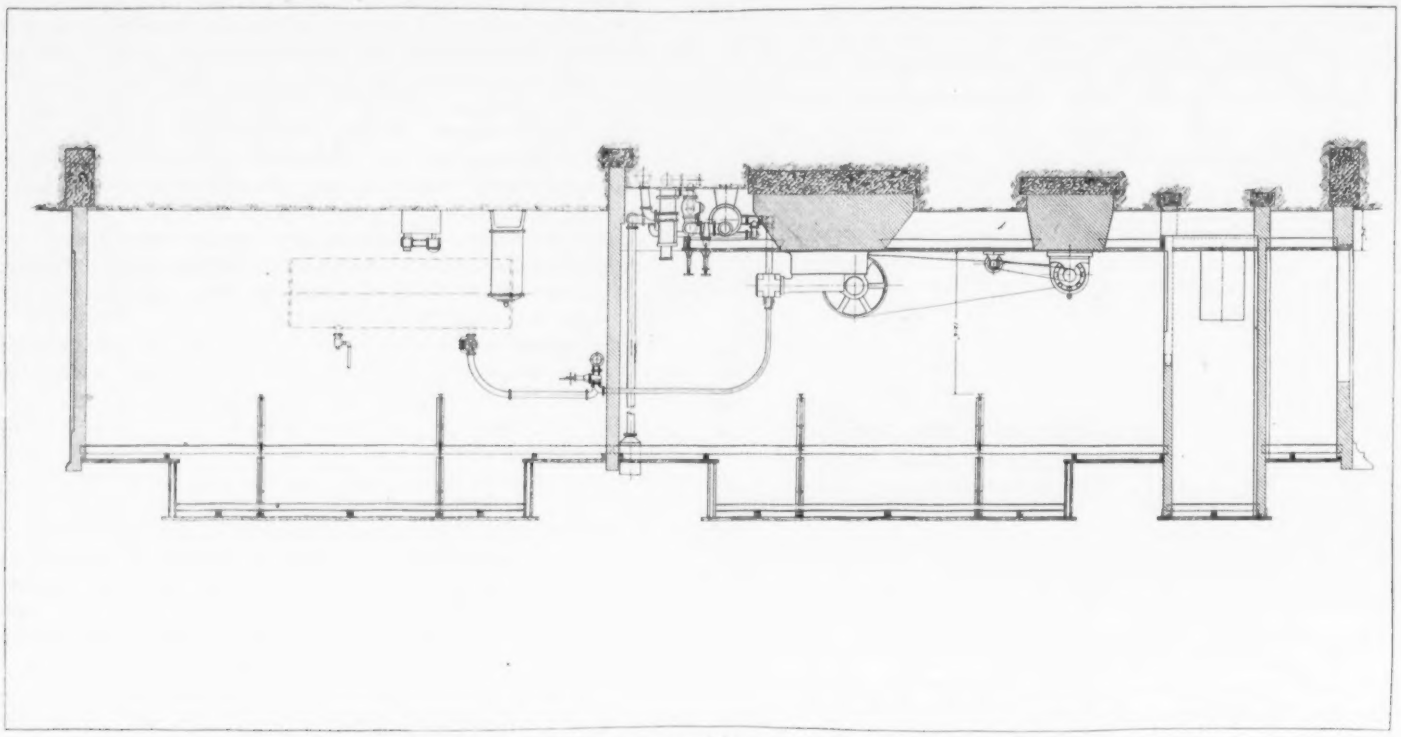

FIG. 3.—ELEVATION OF WALLINGFORD MUNICIPAL ELECTRIC LIGHT PLANT.

At the rear of the switchboard are located three 25-light "tub" transformers which, with 75 enclosed alternating arc lamps for street lighting, were furnished by the General Electric Company. Two of these transformers are operated in series on a 50-light circuit, and the other on a single 25-light circuit, thus allowing for the addition of another transformer of the same size when the number of street lights are increased.

In the superintendent's office are mounted on a marble panel four induction type Thomson recording wattmeters, one for each arc light circuit and one for each of the two commercial circuits, thus allowing for an accurate record of the output each day on the various circuits. As a careful record is kept of the amount of coal burned each day, as well as a record of the amount of water evaporated by means of a water-meter placed in the boiler feed piping, the actual cost per kilowatt output of the station every day is easily obtained. This is of particular importance in view of the fact that under the general laws of Connecticut any municipality operating an electric lighting plant is compelled to pay for street lighting the actual cost of the electric currenrt so used, said cost to include proper care of the operating expenses, interest and depreciation with respect to the total output of the plant.

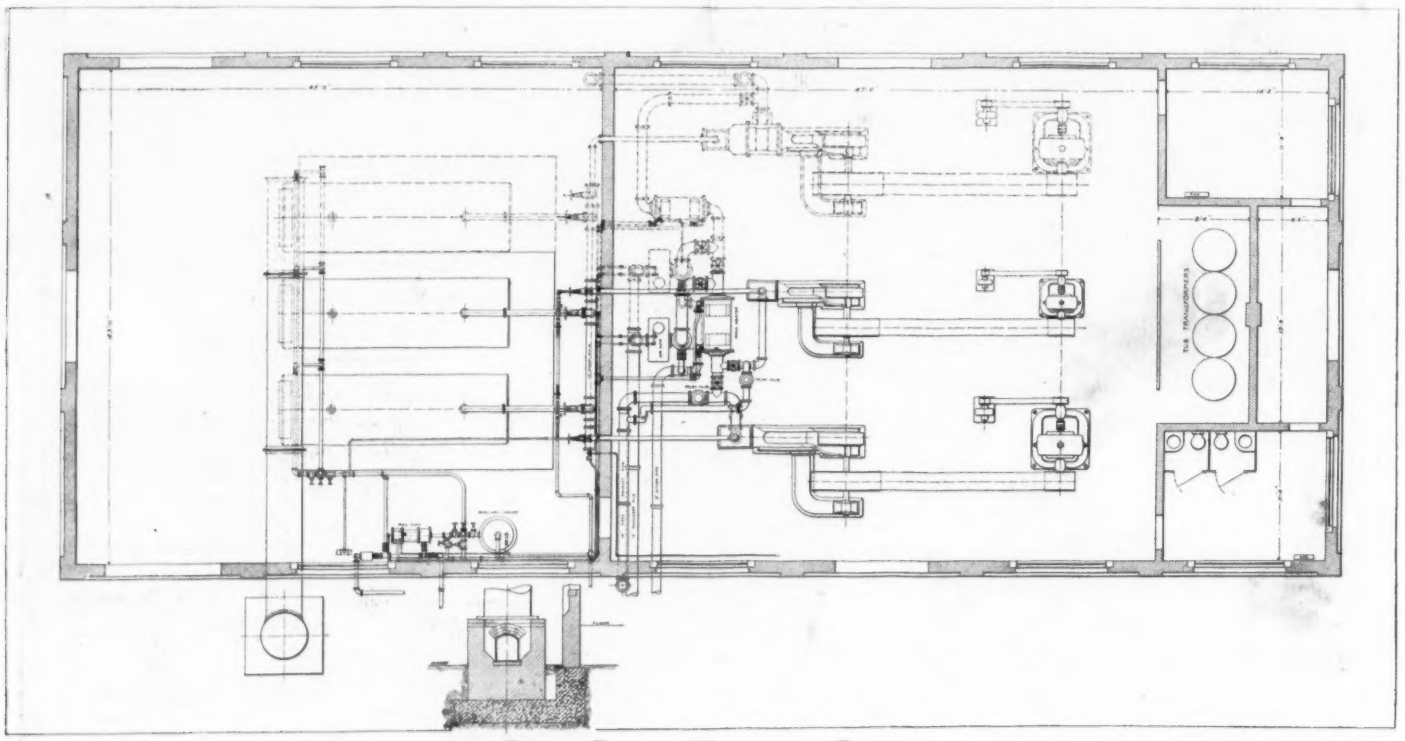

FIG. 4.—PLAN OF WALLINGFORD PLANT.

The accompanying tables give the schedule of charges for incandescent lighting, which have been prepared on the Winchester system. Table I. gives the rates for commercial lighting for stores, offices, club-rooms, public places, etc., and refers to 16-cp lamps. The rates are based on the approximate average of one-half cent per cp-lamp hour, the charges being arranged so that they are higher

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than the average during heavy load and short service, and lower than the average during light load and long service. The first installation of lamps is furnished free to each consumer, including renewals for defective lamps. The minimum monthly rate is not

TABLE I.—RATES FOR COMMERCIAL LIGHTING, 16 CANDLE POWER LAMPS, FOR STORES, OFFICES, CLUBROOMS, PUBLIC PLACES, ETC.

(Winchester System.)

Average Lighting Period. Days or runs per month.	Hours per run.	Average hours per run, per month. Feb., Mar., April.	May, June, July.	Aug., Sep., Oct.	Nov., Dec., Jan.	Average rate per 16 c. p. lamp per mo.	Rates per 16 c. p. lamp per month. Feb., Mar., April.	May, June, July.	Aug., Sep., Oct.	Nov., Dec., Jan.	Rate per 16 c. p. lamp per year.
30 TIMES PER MONTH (EVERY DAY.)											
30	24	24	24	24	24	1.98	1.98	1.98	1.98	1.98	23.76
	12	12	9	12	15	.99	.99	.75	.99	1.23	11.88
	5	5	3½	5	6½	.75	.75	.52	.75	.98	9.00
	3	3	1½	3	4½	.50	.50	.25	.50	.75	6.00
26 TIMES PER MONTH (SIX TIMES PER WEEK.)											
26	24	24	24	24	24	1.72	1.72	1.72	1.72	1.72	20.64
	12	12	9	12	15	.86	.86	.64	.86	1.08	10.32
	5	5	3½	5	6½	.65	.65	.45	.65	.85	7.80
	3	3	1½	3	4½	.43	.43	.22	.43	.64	5.16
13 TIMES PER MONTH (3 TIMES PER WEEK.)											
13	24	24	24	24	24	.86	.86	.86	.86	.86	10.32
	12	12	9	12	15	.43	.43	.32	.43	.54	5.16
	5	5	3½	5	6½	.36	.36	.26	.36	.46	4.32
	3	3	1½	3	4½	.22	.22	.12	.22	.32	2.64
9 TIMES PER MONTH (TWICE PER WEEK.)											
9	24	24	24	24	24	.72	.72	.72	.72	.72	8.64
	12	12	9	12	15	.36	.36	.28	.36	.44	4.32
	5	5	3½	5	6½	.25	.25	.18	.25	.32	3.00
	3	3	1½	3	4½	.15	.15	.08	.15	.22	1.80
4½ TIMES PER MONTH (ONE TIME PER WEEK.)											
4½	24	24	24	24	24	.48	.48	.48	.48	.48	5.76
	12	12	9	12	15	.24	.24	.18	.24	.30	2.88
	5	5	3½	5	6½	.13	.13	.10	.13	.16	1.56
	3	3	1½	3	4½	.08	.08	.04	.08	.12	.96

less than $1, except when less than three 16-cp lamps are in use, or when lighting is not used oftener than once a week. Lamps in cellars, attics, etc., are charged at the rate of 10, 15, 20 and 25 cents per hour monthly, according to the frequency of use. For temporary installation on the basis of 24 or 12 hour service, 10 per cent.

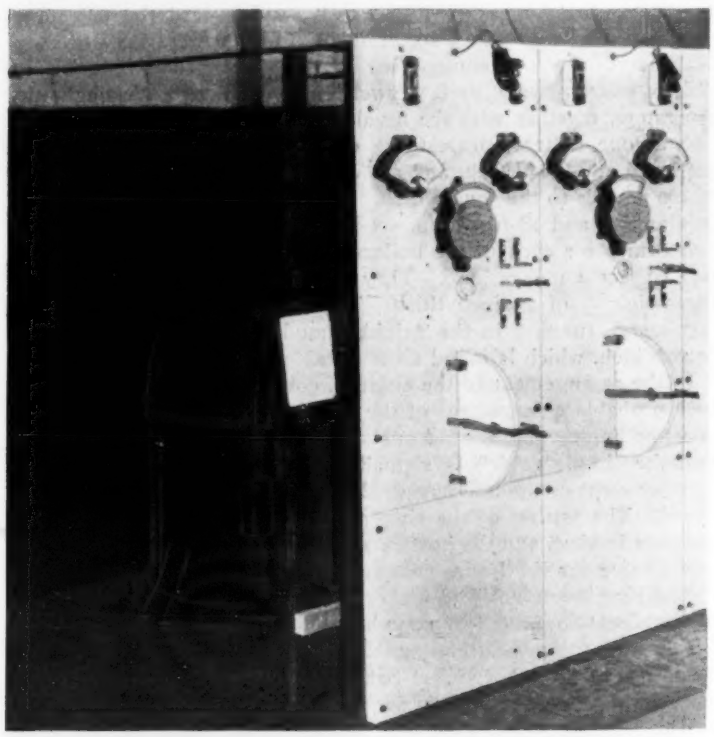


FIG. 5.—VIEW OF "TUB" TRANSFORMER AND SWITCHBOARD.

is added to the rates given in the table; for five-hour service, 15 per cent.; for three-hour service, 20 per cent.

Table II. gives the rates for domestic lighting on the basis of 16-cp lamps. In this case also the minimum monthly rate is not less than $1, and the first installation of lamps is furnished free, with the same condition attached as in the case of commercial lamps.

There are also located on this panel five Bristol recording gauges, one for the steam pressure, two voltmeter recorders—one for each of the two commercial circuits—and two recording ammeters, one for each arc circuit. These instruments have been found to be of great value in keeping a record of the operation of the plant.

The average height of line poles is from 30 to 35 feet, none being less than seven inches at the top, and all as nearly straight as possible and free from knot holes. All cross arms are double-braced and all junction poles double armed and double braced.

Of the 75 street lights now installed, about 50 are suspended by mast arms and the balance from cross suspension. As the lamps are furnished with weatherproof cases no hoods were necessary. The average height from the street is about 22 feet, at which point it is found this type of lamp gives best satisfaction.

Ninety per cent. of the commercial lights are furnished from two three-wire secondary distributing systems covering the main portion of the business streets, as well as a large portion of the residential section, which is fed by a number of 15-kw General Electric transformers, which size and type are made standard in this installation.

The series alternating arc lamps have proved extremely satisfactory in every respect as to quality of light furnished, consumption of current and economy in use of carbons. Approximately, about 10 miles of streets are now lighted and about 30 miles of wire has been strung for both arc and commercial circuits.

The total cost of the plant to the Borough of Wallingford com-

TABLE II.—RATES FOR DOMESTIC LIGHTING, 16 CANDLE POWER LAMPS, FOR RESIDENCES.

(Winchester System.)

Average lighting period and Class No. Days or runs per month.	Hours per run.	Location of Lamps, Name of Room or Place.	Number of lamps.	Average rate per month.	Rates per Month. Feb., Mar., April.	May, June, July.	Aug., Sep., Oct.	Nov., Dec., Jan.	Rate per Year.
No. 1.		Long Burning lamps for halls, vestibules,	1	.76	.76	.38	.76	1.14	9.12
		bath rooms, water	2	1.28	1.28	.64	1.28	1.92	15.36
	About	closets or other locations requiring long	3	1.50	1.50	.75	1.50	2.25	18.00
30	6 hours per light.	service; with three or more one may	4	1.70	1.70	.95	1.70	2.45	20.40
		burn all night, when required	5	1.90	1.90	1.15	1.90	2.65	22.80
		Each additional lamp..		.20	.20	.20	.20	.20	2.40
No. 2.		Average service for sitting rooms, reading	1	.50	.50	.25	.50	.75	6.00
		rooms, studies (libra-	2	.76	.76	.38	.76	1.14	9.12
	About	ries used as sitting	3	1.00	.100	.50	1.00	1.50	12.00
30	4½ hours per light.	rooms, reception	4	1.15	1.15	.65	1.15	1.65	13.80
		rooms as sitting rooms), dining rooms,	5	1.30	1.30	.80	1.30	1 80	15.60
		kitchens, pantries....	6	1.45	1.45	.95	1.45	1.95	17.40
		Each additional lamp..		.15	.15	.15	.15	.15	1.80
No. 3.		Average service for parlors, drawing	1	.40	.40	.20	.40	.60	4.80
		rooms, libraries, re-	2	.60	.60	.30	.60	.90	7.20
	About	ception rooms not	3	.80	.80	.40	.80	1.20	9.60
30	3½ hours per light.	used as sitting rooms,	4	.95	.95	.55	.95	1.35	11.40
		music rooms, billiard	5	1.10	1.10	.70	1.10	1.50	13.20
		rooms	6	1.25	1.25	.85	1.25	1.65	15.00
		Each additional lamp..		.15	.15	.15	.15	.15	1.80
No. 4.		Short service for (halls,	1	.30	.30	.15	.30	.45	3.60
		side entries, bath	2	.50	.50	.25	.50	.75	6.00
	About	rooms, water closets,	3	.70	.70	.35	.70	1.05	8.40
30	2½ hours per light.	used only as required), chambers,	4	.85	.85	.50	.85	1.20	10.20
		dressing rooms, sewing rooms, nurseries.	5	1.00	1.00	.65	1.00	1.35	12.00
			6	1.15	1.15	.80	1.15	1.50	13.80
		Each additional lamp..		.15	.15	.15	.15	.15	1.80
No. 5.		Laundries, cellars, attics, store rooms (en-	1	.20	.20	.20	.20	.20	2.40
		tries seldom used),	2	.40	.40	.40	.40	.40	4.80
	Irregular.	conservatories,	3	.60	.60	.60	.60	.60	7.20
		porches, cupolas, cor-	4	.75	.75	.75	.75	.75	9.00
		nices, private stables.	5	.90	.90	.90	.90	.90	10.80
		Each additional lamp .10-.20, according to probable use.							
30	12	Regular all night lamps	1	.99	.99	.50	.99	1.48	11.88

For residences using light average service (which may be determined by size of family, number of rooms, number of lamps per room, social conditions, etc.), the following discounts may be allowed from the lump rates resulting from the above table:

Per Ct.	75 to 99 Lamps deduct	Class	1	.12	.06	.12	.18	1.44
10-14 lamps... 10	3-7; 100 and over	"	2	.09	.06	.09	.18	1.26
15-44 lamps... 15	charge for each lamp	"	3	.09	.06	.09	.18	1.20
45-74 lamps. 20-25	connected, rates as	"	4	.09	.06	.09	.18	1.44
	here shown	"	5	.12	.12	.12	.12	1.44

plete and in operative condition is slightly under $45,000, the amount of bonds issued for the above purpose, for which the borough has a capacity of 75 arcs and 3250 incandescent lights.

This plant was designed and constructed under the supervision of the writer, of the firm of T. C. Perkins & Co., engineers, Hartford, Conn., and was built on a contract and turned over in operative condition by the Hyer-Sheehan Electric Motor Company, of Newburgh, N. Y.

The Milford, Attleboro and Woonsocket Street Railway.

BY WILLIAM D. ENNIS.

MASSACHUSETTS is full of out-of-the-way towns and villages, which have been overlooked or neglected in the march of steam railway progress, but which, since the advent of electric traction, may be said to have been opened to civilization. Such a village was Westminster, in Worcester County; or Westwood, in Norfolk County; or Rowley, on the North Shore; and with the opening of the Milford, Attleboro & Woonsocket road, a number of towns will undergo a similar experience.

This road, practically completed, and, for a large part of its extent, in operation, comprises forty-two miles of single track in that part of the State lying to the north and northeast of Rhode Island. The eastern terminus is at Plainville, a suburb of the manufacturing town of Attleboro, on the Providence Division of the New York, New Haven & Hartford Railroad. At Plainville connection is made with existing street railway lines for Attleboro, Mansfield, Taunton, Fall River, Providence, Pawtucket and Newport. From this point the road runs southwest to Lake Pearl, then west to Franklin, Unionville and Bellingham. At Lake Pearl a branch runs to the Foxboro line, connecting with the Norfolk Southern road, and thus with Walpole, Readville, Dedham and Boston. From Bellingham the line forks into two branches, one running south to Woonsocket, the other northwest to Milford.

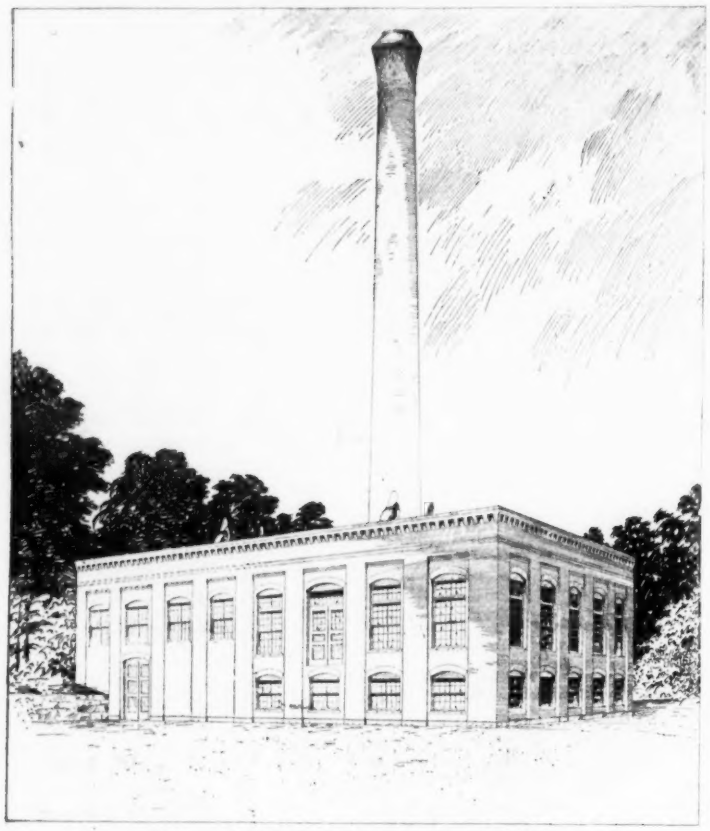


FIG. 1.—EXTERIOR VIEW OF POWER STATION.

None of the towns mentioned have ever enjoyed anything like adequate transportation facilities. Milford, an important center, is on a branch railroad from Ashland to Franklin, and has but nine trains daily. The distance from Boston, by way of Franklin, is thirty-six miles, and the time seventy-one minutes. Poor connections are made at Franklin, and the trip frequently requires three to four hours. Franklin and Woonsocket, both busy manufacturing towns, have no means of intercommunication whatever. Between Providence and Franklin, a distance of 20.1 miles, there is a service of ten trains daily, the average time being 50 minutes. Woonsocket is on the main line of the Worcester Division of the New York, New Haven & Hartford road, and is better off as far as communication with Boston and Providence is concerned. There is no steam railway between Franklin and Attleboro, Mansfield or Taunton.

The new road will fill in these gaps, first by giving a direct communication from Franklin to Woonsocket on the west, and to Attleboro on the east; second, by shortening the time and increasing the schedule from Franklin to Unionville, Bellingham and Milford; third, by giving ready connection from Franklin to Boston, Providence or the southern districts through Attleboro.

The road has been in operation about six months between Woonsocket and Franklin. The completion of the line to Milford has been delayed for lack of rails, but the stock for this purpose has now been secured and is being erected. The line runs to a considerable extent straight across the country on its own ground, and the amount of excavating, grading and filling necessitated was enormous.

The cars at present in use are single truck, vestibule pattern. The line is operated from a feeder taking current at present from the Woonsocket Street Railway Company. This is a temporary arrangement merely, a power station having recently been erected at Unionville, near the centre of the system, and from this, when the apparatus has been installed, sufficient power will be obtained to operate at least the eastern half of the road.

The station is of brick, 90 x 100. A perspective view of the building is given in Fig. 1. Fig. 2 shows the arrangement of the machinery. The plant is located near the Unionville station on the Ashland and Franklin branch of the New York, New Haven & Hartford Railroad, and is planned for a side track near the boiler room, to avoid handling coal. A good sized mill pond, 200 feet from the building, furnishes a supply of water in abundance and of good quality. The chimney is of brick, round, 12 feet in diameter at the base, and 120 feet high, with a round core 5½ feet in diameter. The power station was built by the day, in charge of the general contractor, and the chimney was erected by the Jarvis Engineering Company, of Boston. The car house, located about 70 feet from the power station, is also of brick, 45 by 200 feet. It is 20 feet in the clear from floor to trusses, and is built with four pits, 150 feet long and 5 feet deep from top of rails. Each pit is sloped toward the centre, transversely, and toward the entrance, longitudinally, where they are drained into the sewer.

The station equipment consists of three water-tube Babcock & Wilcox boilers, two Filer & Stowell engines and two Westinghouse generators, together with the usual auxiliaries. The boilers are set two in one battery, nearest the chimney, and one alone. They are rated at 200-hp each, and are designed for a working pressure of 160 pounds to the square inch. Each contains 90 tubes, 4 inches in diameter and 18 feet long, set in 9 rows, 10 in each row. The two drums for each of the boilers are each 36 inches in diameter and 20 feet 4 inches long. They are made of open hearth steel, three-eighths of an inch thick. The sheets are of a special low test metal, running in the neighborhood of 50,000 pounds to the square inch, which is found most suitable for heavy pressure work.

In the arrangement of the engines, consideration has been given to a probable enlargement of the station in the near future. One cross-compound engine and one simple engine have been installed, and the simple engine is virtually the high pressure cylinder of another cross-compound having slightly larger cylinders and higher speed. The setting of the simple engine has been built with this purpose in view, and the heaters and condensers installed are of the proper size for the future compound engine.

The simple engine is 18 inches in diameter by 42 inches stroke, and is direct-connected to a 250-kw Westinghouse generator. This set runs at 120 revolutions per minute. The compound engine is 16 and 30 by 48 inches, direct-connected to a 325-kw Westinghouse generator, at 100 revolutions per minute.

The engines are of especially heavy construction, having been built to specification for the particular service in view. Liberal bearings are provided on all parts, an item well worth attention from designers. Chain oilers are used on all main bearings. The piston rods are supplied with Tripps' metallic packing. The crank pin boxes are of phosphor bronze in the body, lined with babbitt metal. The crosshead pin boxes are of solid phosphor bronze. The cranks are of the disc pattern, and the valves of the "multiported" type. Each wheel is provided with the "Monarch" safety stop. The fly-wheel

of the main (cross-compound) engine is 16 feet in diameter and weighs 40,000 pounds. The wheel on the 18 by 42 engine is 14 feet in diameter, and weighs slightly under 30,000 pounds. The distance from the centre of the low pressure cylinder of the compound engine to the centre line of the crank shaft is 17 feet 5⅝ inches. The high pressure cylinder sets 3¾ inches further forward. The corresponding distance, centre to centre, on the simple engine, is 15 feet 6¼ inches. The distance from centre to centre of cylinders on the compound engine is 17 feet 7 inches. Oil is carried from the main engine bearings to a galvanized iron tank, from which it is filtered and used over again.

Steam is supplied from the boilers through three 8-inch mains to a 12-inch drum. A 6-inch pipe runs to the simple engine, and another 6-inch line is carried to the high pressure cylinder of the compound engine. Both these pipes run through Mosher separators. From the end of the 12-inch drum a live steam connection is taken to the low pressure cylinder of the compound engine. This pipe 7 inches in size, to an 8-inch Mason reducing pressure valve, and thence, 8 inches in diameter, runs to the cylinder. By means of this, the compound engine can be run as two simple engines direct-connected. On all the steam mains bent pipes are used, without fittings.

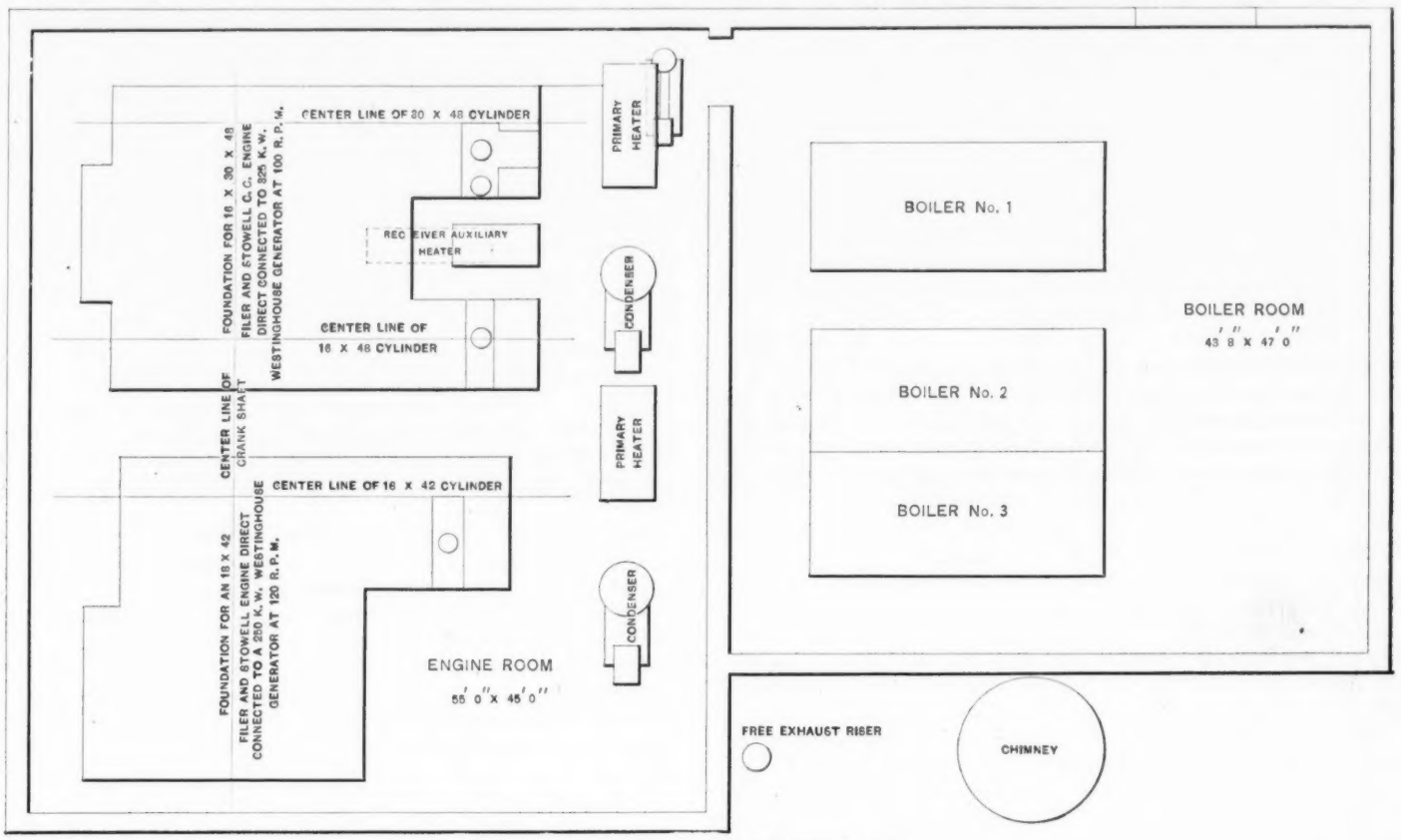

CENTER LINE OF 30 X 48 CYLINDER
PRIMARY HEATER
RECEIVER AUXILIARY HEATER
CONDENSER
CENTER LINE OF 16 X 48 CYLINDER
FOUNDATION FOR 16 X 30 X 48 FILER AND STOWELL G.C. ENGINE DIRECT CONNECTED TO 825 K.W. WESTINGHOUSE GENERATOR AT 100 R.P.M.
CENTER LINE OF CRANK SHAFT
CENTER LINE OF 16 X 42 CYLINDER
PRIMARY HEATER
CONDENSER
FOUNDATION FOR AN 18 X 42 FILER AND STOWELL ENGINE DIRECT CONNECTED TO A 250 K.W. WESTINGHOUSE GENERATOR AT 120 R.P.M.
ENGINE ROOM
55' 0" X 45' 0"
BOILER No. 1
BOILER No. 2
BOILER No. 3
BOILER ROOM
43' 8" X 47' 0"
FREE EXHAUST RISER
CHIMNEY

FIG. 2.—PLAN OF ENGINE AND BOILER ROOMS.

The exhaust from the simple engine is carried through a 7-inch pipe to a primary heater, discharging through a tee either into its condenser or through the relief valve into the free exhaust. The exhaust from the high pressure cylinder of the compound engine is carried to a tee, from which it branches either to a receiver or direct to the primary heater for this engine. From the receiver it is led to the low pressure cylinder. The exhaust from this cylinder runs through a 12-inch cast-iron pipe to a primary heater, and thence, as in the case of the simple engine, either to its condenser or to the free exhaust through an automatic relief valve. The condensers, two in number, have the following dimensions: Diameter of steam cylinder, 10 inches; diameter of water cylinder, 18 inches; stroke, 24 inches. They are independent air pumps and jet condensers, brass lined throughout. The automatic relief valves are of the Deane type. Chapman gate valves and Crosby spring seat globe valves are used throughout on the work.

The boilers may be fed by either pump or injector. A duplex boiler feed pump is set in the engine room basement. This is fed from the main suction pipe running from the pond to the condensers. The discharge may be run through either or both of the primary heaters, or may by-pass both if desired. It is then led to an auxiliary heater, located as shown on the plan, into which the exhausts from the pump and condensers are carried. As the heaters are all of the closed type, a very high temperature should be attained by the feed upon entering the boilers. From the auxiliary heater a 3½-inch pipe carries water to the boilers. This is joined by an auxiliary feed-pipe from the injector, which takes water from a branch of the pump suction. The injector is a compound instrument, the Eynon-Korting No. 10, rated at 450-hp. The draft under the boilers is automatically regulated by the steam pressure, through a Spencer damper regulator.

The car house is heated by direct steam from the power station. This is carried from the end of the 12-inch header, through the boiler and engine rooms, and thence underground to the pits. The pipe is covered, where it runs through the ground, with infusonal earth. A single line of 1¼-inch pipe runs from a 2½-inch header the entire length of each pit. The return pipes slope toward a 3-inch header discharging into Mason traps. A system of water piping is also installed. This runs through the boiler and engine rooms from the field pump, and is tapped at various points for hose connections. The pipe then runs through the trench to the car house, where ten 2-inch hose nozzles are provided.

The general idea prevailing in the design of both buildings and machinery has been to secure massive proportions and solidity without sacrificing grace of appearance. The power station is built with 16-inch walls, overhanging at windows and roof, with notched brick effects in the trimming, as shown in the illustration. The car house has 8-inch brick side walls, the construction being similar to that of the power building. In both, the roof trusses are formed of open triangles (the Warren form of frame), made up of light plates and angles. The main doors of the car house are surmounted with two 7-inch I-beam frames built in with separators. This building is lighted by forty full-light windows, twenty on each side. The power station is also thoroughly illuminated, including the engine room basement, which has been liberally cared for in this respect.

The roofing is composite, and well worth imitation. The body consists of 3-inch yellow pine planks, grooved and splined. On these is placed a thick layer of roof felt, which is succeeded by a coating of asphalt. For a top dressing, tar and gravel are used. As the exhaust pipe is carried through the basement wall and up the outside of the building, there are no leaky joints in sheathing to be apprehended.

With regard to the purely electrical features of the road, little

can be said other than that standard types of apparatus by well known makers have been used exclusively. The generators are Westinghouse engine-type machines, for direct-connection to horizontal engines. The larger one, 325-kw, is directly coupled to an engine rated at 375-hp, at a speed of 100 r. p. m.; the smaller, 250-kw, with the 275-hp simple engine, making 120 turns per minute. At these speeds both machines give 550 volts, being over-compounded for a 10 per cent. rise in voltage from no load to full load. They have all the usual Westinghouse features of ventilation, brush-holding and adjusting devices, and oiling mechanism, for this type of generator. The same company had the contract for the switchboard, which is of marble, of the five-panel style for generators and feeders. Shallenberger meters, Wurts lightning arresters, and the Westinghouse quick-break knife switches will be used. The mounting is from angle iron standards, secured to wall and floors, and the wiring is, of course, all back-connection work.

The car equipments are Westinghouse and R. D. Nuttall's types. Twelve A motors are used both for the four-motor (double truck) and two-motor cars.

The cars have been purchased from three makers, Wason, Laconia, and J. M. Jones' Sons. Eight double-truck vestibuled cars are in use, each seating fifty persons. They are cross-seat cars, with electric heaters, Westinghouse motors and controllers. Eighteen open cars, six with ten benches each, and twelve with fifteen benches each are provided for summer service, the six ten-bench cars having single trucks. Every car is heated by Taunton coils placed under the seats.

The power station at Unionville will probably be exactly duplicated by the auxiliary station to be shortly installed at Milford. A double-feeder system has therefore been adopted, the short branch being 300,000 circular mil cable, and the long one 500,000 circular mil. The trolley wire is No. 00.

The road is 4 feet 8½-inch (standard) gauge, laid with 60-foot rails of 60 pounds weight, 4½ inches high. Several miles of the roadbed run across private land, and cuts and fills of 25 feet depth were sometimes encountered. The working force necessary to handle such operations was fully as large as that employed in locating the average steam road. Wood poles with iron arms, and chestnut ties, 6 by 6 inches in size, are used throughout.

The officers of the road are: J. G. Ray, Franklin, president; E. K. Ray, Franklin, treasurer. W. H. Tylee & Co., Worcester, as general contractors, are managing the road pending its completion. This same construction company built the Worcester & Clinton road in 1898. Hodges & Harrington, of Boston, were the engineers for the construction of the road. Richard P. Jenks, of Providence, furnished the designs for the power station, car house and station equipment.

The present status of the enterprise is as follows: Cars are running on a regular one-hour schedule between Franklin and Woonsocket, charging a 15-cent fare. Power is obtained from a foreign company, as explained. The generators for the power station, the only incomplete item in the plant, have just been shipped. Seventeen miles of the road have been built complete and can be placed in operation at any time. All the stock for the remaining portions has been delivered, and the entire system will be running by June 1.

To illustrate the methods used for facilitating delivery, it may be mentioned that iron pole arms, instead of being bought from jobbers, subject to delays in shipments and excessive prices, are made up at each pole by a Stilson wrench and a little oil, the component parts being lengths of one-inch pipe, properly cut and threaded, and a few fittings and screws. A spirit of enterprise has controlled the entire construction, and the road will be one of the best examples of interurban electrical traction on a large scale that has yet been seen.

Electricity on the Reading Railroad.

It was recently reported that the Reading Railroad was considering the establishing of an electric service between New York and Philadelphia. Referring to this matter an official of that road is reported to have said that no official action had yet been taken on the subject, but that plausible suggestions had been made, and that they would get down to the idea in time. The matter of economy of operation, he said, had been considered, and there seems to be little doubt that with electric motive power in place of steam a reduction of expense could be effected.

Extension of Electrical Supply from Three-Wire Stations.

BY ALTON D. ADAMS.

THE three-wire, direct-current distribution system with 110-volt lamps seems to reach its economic limit at little more than one mile from a single station. Where, however, the main generating plant is supplemented by substations, to which current may be transmitted on two wires at pressures 275 to 300 volts, the practicable radius of supply may be extended up to fully two miles from the central station. The pressures just named, for transmission to these substations are obtained by devoting one or two of the regular direct-current dynamos to the purpose.

Formerly it was the custom to equip three-wire stations entirely with dynamos rated at 125 volts pressure, so as to use all machines in pairs for purposes of regulation. On a well regulated three-wire system the load on dynamos connected to the positive and neutral wires never varies more than a moderate percentage from the load on dynamos connected to the negative and neutral wires, so that much less than the entire capacity of dynamos on either side of the system ever comes into use to balance the loads of the two sides. Advantage of this fact is taken by the recent use of single dynamos, having pressures of 250 to 300 volts, to carry parts of three-wire station loads through connections to only the positive and negative wires. These dynamos, intended to connect only with the outside wires of the three-wire system, are given a range of operative pressure from 250 to 300 volts, so as to be used either on feeders running direct to supply mains in parallel with pairs of 125-volt dynamos, or the two-wire feeders that connect the generating with substations. The higher of the pressures just named is required for the feeders to substations, because the drop in volts allowed on these feeders is often greater, at full load, than the drop on feeders to service mains. At the substations, pressure regulation for the local service there is accomplished by motor-dynamos or dynamotors and storage batteries. Where a single generator of the higher voltage is not at hand, a pair of the regular generators connected in series may, of course, be used on substation feeders, as is often done.

This increased radius of operation up to about two miles from the generating, for three-wire systems, using 110-volt lamps, is still much within the limits where desirable loads can be found for many central stations, and managers are at this time looking for suitable means to extend their service area.

Three main plans for this purpose at present seem available with varying degrees of desirability. Ideal means, to extend the service area of three-wire, direct-current stations should add to the equipment, at the generating plant, only one unit of machine capacity per unit of increased output, and should not increase the relative amount of auxiliary apparatus at substations, while the added generators at the main plant should operate on any part of the load in multiple with present dynamos.

The first plan, apt to be presented for an increase of the service area of a three-wire station, is that one or more high pressure, alternating generators be added to the equipment, and used to supply the more distant loads through substations with transformers and rotary converters, besides the batteries that a purely direct current substation would require. This plan is open to the objection that the high pressure alternating generators cannot be operated directly in parallel with those for low pressure direct current, and can be used on that part of the three-wire load that is supplied by feeders from the main station, only by the use there of step-down transformers and rotary converters. Three units of capacity are thus necessary for each unit of output through the high pressure generators, whether this output occurs from the main or substations to distribution lines. High pressure alternating current generators thus fill neither of the three requirements above stated for ideal means to reach distant loads.

A second method, by which the loads, beyond the present radius of ordinary three-wire stations, may be reached, is that with double current generators at the main plant. Such generators are designed to correspond in voltage with the outside or positive and negative wires of a three-wire system, as to their commutation connections, and the alternating current from their collector rings is delivered to station transformers that raise the pressure to that desired for transmission to substations. At substations the step-down transformer and the rotary converter are required to reduce

the pressure and deliver direct current to batteries and the local three-wire system, just as with high pressure alternating generators at the main station. Equipment with double-current generators, at the central station, for loads beyond the 250-volt radius, meets one of the requirements for an ideal addition, inasmuch as these generators may operate in multiple with those of the purely direct-current, low pressure type.

There remains, however, the objections that transformers at the main plant make the capacity of apparatus, delivering energy to substation lines, twice its output. Also that substations have rotary converter and transformer equipments of twice the delivery capacity to local lines. Comparing, then, either the addition of high pressure alternating generators or of low pressure double current generators with present electric equipment, for the supply of substations on the three-wire system, it seems that the introduction of alternating current in either way must increase the capacity of the apparatus involved in the substation service at least four times.

Assuming, as is actually the case with a large per cent of three-wire stations, that the desired increase of service area is within two, three, or four times their present 250 to 275-volt radius, let it be noted what can be done with the direct current dynamos now in use. In spite of the fact that incandescent lamps of pressures from 220 to 250 volts have been on the market for more than two years, nearly all three-wire stations continue to supply 110-volt lamps. All other things being equal, the 110-volt lamp is somewhat superior to that for 220 volts, because of its greater life for given efficiency and degree of pressure regulation. The most important reasons for the delay in the introduction of 220-volt lamps seem to arise from the great change these lamps would make necessary in existing electric stations, distribution systems and in the wiring and fittings of buildings. For the supply of 220-volt lamps it would be necessary to change the pressure of station dynamos from 125 to 250 volts. The insulation of many three-wire feeders and service mains would probably prove insufficient, in their present condition, for 500 volts pressure. Much the greater portion of electric circuits in buildings would require extensive changes to meet the views of underwriters, if lamps of double the present pressure were adopted and many of the old fittings would have to be changed. On new electric stations, systems and building circuits, these objections do not apply, as dynamos of the double voltage cost no more, and provisions for twice the older pressure add but slight expense on new wiring.

Since 220-volt incandescent lamps became a commercial article, a growing preference for them has been noted in the design of new three-wire stations and systems. Under the well-known law, that the distance to which electric energy may be transmitted, at a fixed per cent of loss in, and weight of conductors, varies as the square of the voltage at which the transmission takes place, the 220-volt lamp increases the radius of operation for three-wire stations and systems four fold. Where a new three-wire plant is to be built or an old one can be changed for the use of 220-volt lamps, the total pressure of 450 to 500 volts will warrant as much increase in the radius of supply as is desirable for many three-wire stations.

The important question of extensions in service area, for a large number of the present 220-volt, three-wire stations, that cannot change to 220-volt lamps, as to present loads still remains. As already noted, present practice in three-wire stations includes the use of 250-volt generators, connected to the positive and negative wires only, for a part of the loads, and the operation of these generators, in some cases, at pressures as high as 275 volts, when employed to supply substations having storage batteries, over feeders with a comparatively high per cent of loss. It seems that these same 250-volt generators, instead of operating singly or in parallel on the feeders to substations, may well be connected in series of two, so as to supply distant substations on the three-wire, 500-volt system, using 220-volt lamps. Such a practice, leaving the 250-volt supply system of existing stations as at present, but adding substation systems at 500 volts, would, of course, make it impracticable to interconnect existing mains with those of new and distant substations, but it does not appear that this would be a great disadvantage. When taking business for a new substation it would be easy to insist on and secure service to lamps of only 220 volts. These 500-volt substations would enable a main station to greatly increase its motor load, also, because of the great area to be served with motors of this pressure.

It should be noted that the use just named, for 220-volt dynamos, adds nothing to the machinery equipment at either main or substations, beyond one unit of capacity per unit rate of output. If, however, the more conservative, for any reason, hesitate to adopt 220-volt lamps for even new work, or to introduce two voltages to supply into their distribution systems, another alternative by which the advantages of the 500-volt pressure, for transmission between main and substations is obtained, presents itself. Distant substations may distribute current to 110-volt lamps and still receive energy from the main plant at from 450 to 500 volts. This may be done in either of several ways. The storage batteries may be charged at about 500 volts and discharged on a three-wire system of 250 volts. This system will give very satisfactory results, but is objectionable because the battery capacity must equal the substation output at maximum load, which requires more batteries than are commonly employed.

Another plan is to charge the battery at about 500 volts, at the same time that the batteries and the central station feeder supply a five-wire system in multiple. This last arrangement includes only a moderate battery equipment, which may be further reduced if dynamotors are used to balance the variations of load between the four-lamp circuits. It seems, therefore, that 250-volt generators, such as now used at three-wire stations, furnish by series connection an ideal equipment for the material extension of service areas.

A Novel Application of Electric Heat.

BY E. J. HART.

THE authorities of Marquette, one of the most prominent towns in the upper peninsula of Michigan, believe they have hit upon a plan of warming the water of Lake Superior on an electric stove before admitting it, through the intake pipe, to the city water works system, and by carrying their plan into effect at a cost of $25, they consider they have averted the necessity for changing the location of the pumping station and intake pipe at a cost of from $50,000 to $100,000.

For many winters past the city has been greatly bothered by ice from the lake, which has choked up the intake pipe so as to entirely shut off the water supply and necessitate the closing down of the pumping station. This has occurred dozens of times in the past few years, and water famines have resulted annually. It has been necessary in each case of a "choke-up" to thaw out the mouth of the intake with salt, but this has only remedied the evil temporarily, and after some delay and a great deal of trouble. The trouble has grown to such proportions that the question of spending many thousands of dollars to change the location of the intake pipe and pumping station had been agitated.

The trouble at Marquette was not with the surface ice of the lake, but with "needle ice," as it is called. When the lake freezes over the water supply is not affected, and the surface ice is rather a protection to the intake. The trouble comes, however, when the ice fields are carried out of the bay by winds, and the same winds prevent new ice from forming on the surface. Small particles of ice—"needle ice"—form, and then millions of the particles mass together and are carried into the intake pipe. The vertical section of this which admits the water is 2 feet in diameter, but the masses of ice are sufficient to entirely block it.

About three weeks ago a famine of unusual severity resulted from an ice blockade of this sort, and the city water board solicited the assistance of some local engineers to remedy the trouble; if possible, permanently. Superintendent Charles Retallic, of the municipal electric light and power plant, was one of these, and he devised a plan by which it is hoped to do away with the evil entirely. The plan provides for an electric heater of cylindrical form, hung concentrically within the opening of the vertical section of the intake pipe. This heater was completed and put in place last week, and it will be tested as soon as the wind again carries away the surface ice and the conditions are suited to the formation of the fine ice particles that cause the trouble.

The heater is of the iron resistance coil pattern, and the only novelty about it lies in its adaption to the use for which it is intended. It consists of an inner and outer drum of galvanized iron, respectively 19 and 21 inches in diameter, and both 5 feet in length. The inner drum has flanges at the ends extending outward, and to these the outer drum is soldered. The inner cylinder was wrapped with asbestos sheeting to a depth of nearly half an inch, and around this were wrapped convolutions of No. 18 iron wire, in one continuous spiral. Terminals were carried through the flange at one end.

through water-tight gaskets of heatproof insulating material. Iron shoulders are riveted to the apparatus and by means of these it is hooked over the top of the intake pipe. It extends from the top of the vertical section of the intake to within two feet of the horizontal section, and the former only stands seven feet high.

Current is supplied from the electric light wires at the water works plants on the beach. It is carried through conductors intended for submarine service, and where the wires enter the water they pass through a conduit of iron piping to protect them from shore ice. The stove will generate enough heat, it is believed, to melt all the needle ice before it passes through the cylinder. The plan is not to keep it in constant use, but only when the conditions of the weather are favorable to the formation of this sort of ice.

A Faradmeter.

AT the February meeting of the American Institute of Electrical Engineers Prof. M. I. Pupin described a faradmeter based upon the employment of alternating currents. The usual method of measuring capacities by the ballistic galvanometer often introduces serious errors from leakage and absorption, and one object of the meter is to reduce such errors to a desirable limit.

In addition to this consideration, which concerns the accuracy, another important consideration is the convenience of the proposed method and the cheapness and durability of the apparatus to be employed. Much of capacity measurement work, especially in connection with telegraphy, telephony and the construction of alternating current machinery, has to be done under conditions under which it is quite inconvenient to employ the ballistic galvanometer, while the faradmeter described answers quite satisfactorily all reasonable requirements as regards convenience.

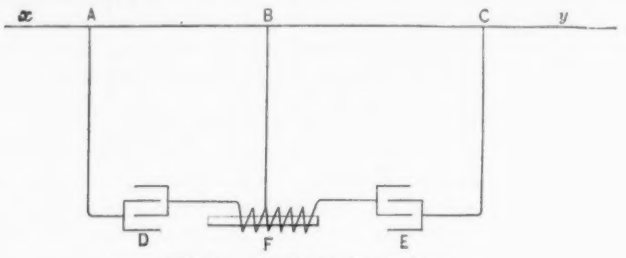


FIG. 1.—DIAGRAM OF CIRCUIT.

The theory on which the construction of this meter is based is as follows: Let $x\ y$ (Fig. 1) be a conductor through which an alternating current flows. D is a condenser of known capacity and E is a condenser of unknown capacity; F is a differentially wound telephone. Connect as indicated and adjust the resistances $A\ B$ and $B\ C$ until silence is obtained in the telephone. Then capacity of D : capacity of E : : resistance of $B\ C$: resistance of $A\ B$. It is understood, of course, that the resistances $A\ B$ and $B\ C$ are non-inductive and that the capacity reactance of each condenser is in its own circuit by far the greatest element of the impedance. These conditions are fulfilled in the apparatus shown in Fig. 2 which was constructed for

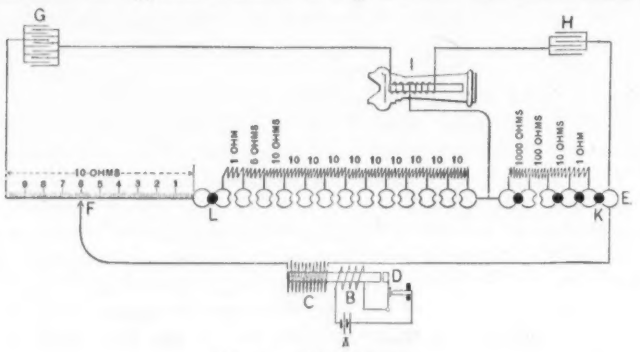


FIG. 2.—FARADMETER.

Dr. Pupin by Mr. E. V. Baillard and employed by him in some work which he has been doing for the former during the past two months.

In Fig. 2, A is a cell which feeds into the primary B of a small induction coil provided with an interrupter such as is used in electrotherapy. The secondary C is connected to a row of resistance coils E and L. These resistances are arranged in convenient steps as indicated. The resistance coils L have in addition several equal lengths of manganin wire F stretched over a graduated scale. The resistance of the coils as well as of the manganin wire is carefully calibrated once for all. The condenser H is a carefully constructed mica condenser of known capacity. G is the condenser the capacity of which is to be determined. I is the differentially wound telephone. The approximate adjustment is accomplished by the plugs which control the resistances E and L, and the final adjustment is made by the manganin wire by a sliding contact F which varies the length of the manganin wire to be introduced, and therefore varies the drop which acts on one of the condensers. With ordinary frequencies capacities up to several microfarads can be determined with an accuracy of a small fraction of one per cent. easily and rapidly.

It is self-evident that in place of the differentially wound telephone I, an ordinary telephone can be used, placed in the bridge which connects a point between G and H to a point between the resistance coils E and L. The conditions of balance are the same as in the method employing the differentially wound telephone. In many practical cases this second method is preferable.

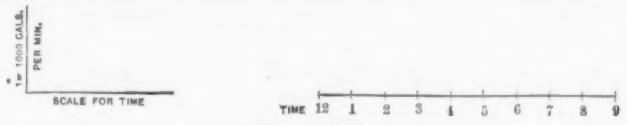
Power Transmission in England.

Our London correspondent sends the subjoined interesting data as to power transmission in England: I have already referred in these columns to the Lancashire electric power scheme, a scheme under which it is intended to build a large electric power plant in the immediate civinity of the coal pits in Lancashire and from there to distribute electricity in bulk to neighboring towns and boroughs, at a very much less cost than they can themselves produce it. The scheme is undoubtedly good and should be encouraged, but owing to tremendous jealousies, the local authorities through whose territories the wires would have to pass are now organizing for the purpose of opposing it, and a meeting has just been held in Manchester, at which representatives of 35 urban district councils in Lancashire were present who unanimously passed the following resolution: "That this meeting of urban district councils hereby decides to oppose the Lancashire electric power bill, 1900, for the purpose of obtaining protective clauses, and that a committee be appointed to formulate and carry out such opposition, and that the costs thereof be borne pro rata according to ratable value." This will give some idea of the grave difficulty which progressive electrical engineers have to encounter in England, and why it is almost impossible to see power stations in England which are economically producing current. The local authorities of the towns place every difficulty possible in the way of an enterprising company, notwithstanding the fact that they could buy the current necessary for their own lighting at probably one-third the price that it costs them to produce current in their own small and, therefore, inefficient stations. Each local authority wants to control its own little situation, and the consequence is bad work, lack of progress and the stifling of all enterprise of a progressive character, which would place England on a par with modern countries. It seems to me from a study of this power scheme, as well as of half a dozen other similar schemes in other parts of England, such as the Tyneside, the South Wales, the Midland and the County of Durham, that the companies proposing to distribute power, have all been conceived in a spirit of the utmost fairness. They are not seeking to establish monopolies, to the detriment of electrical enterprise in their vicinity, and do not wish to compete with local authorities in their lighting and tramway schemes. Primarily, however, they are seeking the right to pass through the streets, underground when necessary, for the purpose of reaching wholesale consumers, and at the same time would offer the local authorities electricity in bulk at a very reasonable figure if they desired it. In these circumstances it would appear likely that such companies would be encouraged by the local authorities, but, no, the town councillor and the association of town clerks are opposing these schemes tooth and nail, being utterly unable to grasp the possible benefit to their own citizens and being utterly unable to look beyond the rates which they can establish by their municipal trading. Each local authority must therefore keep all its enterprise at home, and no matter if their towns and cities are being dwarfed by dear power, as long as it is manufactured at home, the whole weight of their objection will be thrown against outside enterprise which would furnish them with cheaper power, and consequently with the stimulus for building up their trade. They are, however either too short-sighted to see this, or are too selfish to look beyond the possibility of personal aggrandizement and greater probabilities of political power in their own little kingdoms.

Fundamental Ideas of Alternating Currents.*—I.

BY PROF. DUGALD C. JACKSON.

A DEEPLY rooted belief seems to have been cultivated in the minds of many that the phenomena connected respectively with the flow of continuous electric currents and of alternating electric currents are as widely separated as are the extremes of the diameter of eternity. This popular idea, however, is totally erroneous and the principles which relate to the flow of direct and alternating currents and which are applied to the design and construction of machines and circuits are one and the same. In this paper will be given a straightforward statement of the elementary electric and magnetic principles which relate to the flow of alternating currents. To the majority of those interested in the subject, the paper contains no new information; those to whom it is new will perhaps not be uninterested. I have even been careful in choosing analogies to select as far as possible those heretofore used in electrical literature, and have then utilized them in the most straightforward manner for illustrating electrical phenomena.



FIGS. 1 AND 2.

When Oersted, in 1820, made known his signal discovery that an electric current exerts a magnetic influence in the space around it, the foundation was begun for our knowledge of the laws of the flow of alternating currents. Within a dozen or fifteen years thereafter, much knowledge of the magnetic effect of the electric current has been thrashed out experimentally by men like Ampere, Arago, Faraday and Henry. And the last two laid the finishing stone on the foundation by searching out and making known the laws of electromagnetic induction.

The apparent flow of electric current may be likened to the flow of a fluid, and it may be either *continuous, pulsating* or *alternating*.

1. The first is analogous to the flow of an unbranched river through its channel, in a season of uniform flow. The water flows continuously onward without pause or hesitation. The velocity of the stream is affected by the character of the banks and the contour of the country traversed; but the onward motion of the volume of water never ceases and the quantity of water flowing past any cross section of the channel is always the same, though its width, depth and velocity may change with the character of the channel. We may represent the flow in a graphical manner in this way: Suppose distances measured on the vertical from a zero or horizontal line represent the quantity of water which each minute flows past some point along the river. Then a vertical line one inch long, we will say (Fig. 1), means that 1000 gallons of water pass the point in every minute. Now suppose a number of measurements are made through twenty-four hours and the clock times when the measurements are taken are recorded. Then we have a number of vertical lines each one inch long for every 1000 gallons per minute to represent the amount of water flowing at each instant through the day and night. We can now extend our chart, and divide our horizontal line of zero quantity into parts each representing one hour, as in Fig. 2. And at each of the clock times set down we may erect the vertical which has a length corresponding to the quantity of water flowing. This river is continuous in its flow and all the verticals are therefore of equal height, as in Fig. 3.

We may take our observations of flow as frequently as we choose and erect the corresponding verticals at the points corresponding to the clock times of the observations. Finally, by drawing a line through the tops of the verticals we have a chart which shows by the vertical height of this line the rate of flow at any time during the twenty-four hours (Fig. 4).

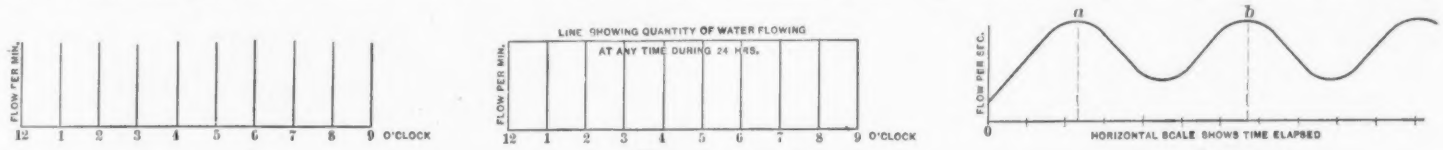
*Paper read at the Convention of the Northwestern Electrical Association.

In the case that we are considering—that of continuous flow—the line drawn through the ends of the verticals is a horizontal line, that is, the chart shows that the flow of the water is uniform.

2. A *pulsating* current may be likened to the flow of arterial blood. With each heart beat the blood rushes forward and then slackens in velocity, and then again rushes forward as the heart beats again. Our chart, which shows the quantity of blood flowing through the artery at each instant, is in this case composed of a wavy line which never crosses the zero line, as is shown in Fig. 5.

The horizontal scale now, instead of being made in hours, may be more conveniently made in seconds or fractions of a second, since the blood pulsations come many times per minute, and the vertical scale may be made to represent a flow in fractions of a fluid ounce per second instead of gallons per minute, because of the limited amount of blood that flows in an artery. The vertical height of the wavy line in the chart, above the horizontal scale line, still shows the amount of blood flowing at each instant corresponding to the times read on the horizontal scale. The *frequency* of the heart beats is the number of pulsations made per minute, which is not far from 70 in the average human adult, and the duration or *period* of the pulsations is therefore not far from one-seventieth of a minute. The period is represented on the chart by the time elapsed between two like points, as the two points of greatest flow, *a* and *b*.

3. Finally, the *alternating* current may be likened to the flow of water in a narrow tide way. As the tide rises the water rushes up the channel until near high tide, when the flow gradually ceases, turns, and then, with increasing flow, the water rushes down the channel until near low tide, when its outward flow gradually ceases, turns, and with increasing flow the water begins to rush up the channel again. The action is repeated again and again as the days pass by, the *period* of the complete action or cycle, i. e., from low tide to high tide and back again is a little over twelve hours, and the *frequency* is therefore nearly two periods per day. We can represent this *alternating flow or current* also by a chart, as shown in Fig. 6.


FLOW PER MIN.
12 1 2 3 4 5 6 7 8 9 O'CLOCK
LINE SHOWING QUANTITY OF WATER FLOWING AT ANY TIME DURING 24 HRS.
FLOW PER MIN.
12 1 2 3 4 5 6 7 8 9 O'CLOCK
a
b
FLOW PER SEC.
0
HORIZONTAL SCALE SHOWS TIME ELAPSED

FIGS. 3, 4 AND 5.

Assuming the period to be exactly twelve hours (which is near enough for the analogy), and taking a day in which low tide occurs at 12 o'clock noon; then, at this time (12 o'clock noon) no flow is occurring; a little later the flow is up the channel as the tide rises, and the rate of flow increases for a time. This portion of the tidal period is represented by the portion of the curve between *a* and *b* in Fig. 6. It is to be borne in mind that the vertical height of the curve shows the amount of water flowing per minute at the instant considered (not the height of the water). The flow continues up the channel for a farther length of time, but at a decreasing rate,

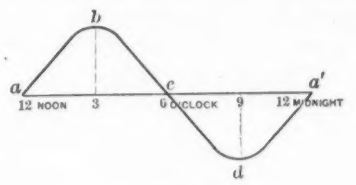


FIG. 6.

until high tide is reached at 6 p. m. Then, for an instant, there is no flow of the water. In representing this, our curve, dropping down from *b*, crosses the line of zero flow at the point marked *c*, which corresponds to the instant of no flow at the time of high tide.

Half a tidal period has now been completed, the tide has reached its flood and begins to fall, and the flow therefore reverses and runs outwards. Since the flow inwards or up the channel is shown on the chart by a vertical distance above the line of zero flow, it is natural to represent the outward flow by a vertical distance below the line. After the turn of the tide the amount of flow increases for a time up to a minimum and then decreases as the low tide is approached. This is represented by the curve from *c* through *d* to *a'*. At the latter point, low tide has been reached and an entire cycle of the tide has been completed and is represented on the

chart. The chart might be continued indefinitely, representing the cycles of successive periods if desired, as in Fig. 7.

It is well known that the character of the tidal flow is greatly affected by the character of the channel. For instance, in a narrow, crooked channel, the phase of the flow is retarded as one proceeds along its length, through the buffeting action of the banks. And the times of high and low tides, when the flow in the channel is zero, may not correspond with the times of similar tidal phases in some other channel or in the open sea. In this case we may say that the tide in one channel differs in phase from that in the

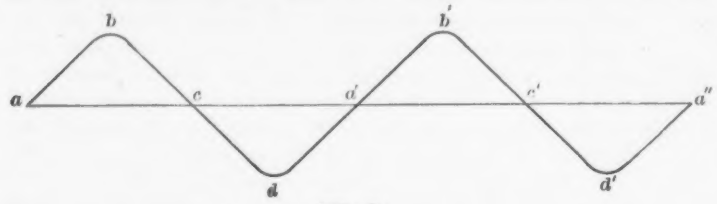


FIG. 7.

other, or that in the sea, and a chart may be drawn to represent the respective cycles of sea and channel tides at certain selected points, as in Fig. 8. In this figure the tidal cycle in the channel is shown to be *retarded or behind the tidal cycle of the sea.*

Alternating currents of electricity, flowing in branch circuits, may be at different phases, and they may be represented on a chart entirely similar to that of Fig. 8. The currents are said to be out of phase, and may be said to be in advance of or behind each

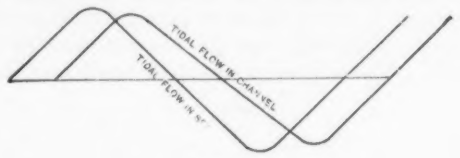


FIG. 8.

other, depending upon which is looked upon as the datum for comparison; exactly, for instance, as we may with equal propriety, and the same meaning, say either that the channel tide is behind the tide of the open sea, or that the tide of the open sea is in advance of the channel tide.

To recapitulate, the electric current may be continuous, pulsating or alternating. The first is likened to a continuous flow of a river, the second to the pulsating flow of arterial blood, and the third to the alternating flow of water in a tide way. Continuous and pulsating currents, that is, currents which flow continuously in one direction, are often called "direct currents."

Electrical Export Trade Outlook.

The latest issue of the Journal of the Bureau of American Republics has the following notes of electrical interest:

The municipality of Rosario, Argentine Republic, has granted Señor Frederico Scharrer permission to establish an electric light plant with underground wires for the term of fifty years, he paying 5 per cent. of the gross receipts to the city. A proposition has been submitted looking to the establishment of electric tramways.

The contract agreed upon between the Municipal Council of Montevideo and the representative of the Reducto, Este, Positos, Buceo and Union Tramway Company, calling for the change of traction from animal to electric, was signed on Dec. 7, 1899. This contract will have to be submitted to the Uruguayan Congress, and should the delay in obtaining its sanction not be excessive it is stated electric cars will be running in the capital soon.

In January a machinery dealer in New York shipped twenty woodworking machines to Guayaquil, Ecuador, for use in a furniture factory and planing mill. The same firm has submitted proposals for furnishing the city of Guayaquil with an electric lighting plant, the outfit to include three large engines and dynamos. The contract will be awarded in June.

Work upon the electric railroad which is to connect the city of Lerdo, Durango, Mexico, with the flourishing town of Torreón, Coahuila, has been begun.

The Topo Chico street railway line in Monterey, Mexico, is being extended. Mr. S. W. Slayden, of Waco, Tex., is the proprietor.

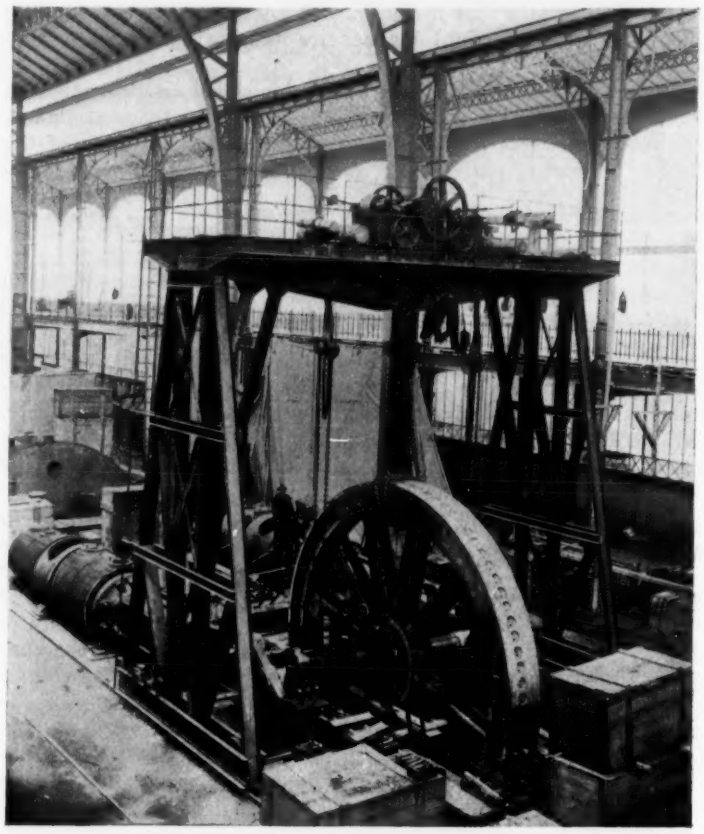
The Compania Telefónica Jalisciense has established a telephone system in the city of Guadalajara, Mexico. The equipments were purchased in the United States.

The Paris Exposition.

The buildings for the International Exposition at Paris are beginning to take on an appearance of completeness, but there is still very much to be done, so that the installations of the different exhibitors cannot progress quite as smoothly as might otherwise be the case. The building for the American section at the Bois de Vincennes is being erected by the Berlin Iron Bridge Company, of East Berlin, Conn., which company has made a noteworthy record in the erection of the building, distancing all others engaged in similar work here. The whole of the iron work, enclosing a ground area of 348 feet by 79 feet, was put up by two gangs of ten men each in six working days. At present the roof is nearly completed, and the masonry walls are being put in.

It has been found that the space in this building would have been too small for the latest requirements, and an annex is being added by a French contractor. Steam supply for this building is to be furnished by two Climax boilers of 250-hp capacity each, put in by the Clonbrock Boiler Company, of Brooklyn, N. Y.

In the Palace of Electricity and Machinery, on the Champ de Mars, there will be two complete central stations, each with a large ornamental smokestack. In the station on the Avenue de Suffren side there is being installed by the Helios Electric Company, of Cologne,



ERECTING LARGE ALTERNATOR AT PALACE OF ELECTRICITY.

under the direction of their engineer, Mr. C. L. de Muralt, a large flywheel alternator driven by a triple-expansion horizontal steam engine of 3000-hp, shown in the accompanying cut. The distance between centres of bearings is 15.4, and the diameter of the journals is 20 inches. The flywheel is 31 feet in diameter, and will carry on its periphery the field bobbins, secured by bolts passing through the rim. The frame of the alternator will be built round the revolving field magnets, and will have an outside diameter of 49 feet. The speed of rotation is 70 r. p. m., the stroke 5½ feet, and the boiler pressure 175 pounds. The engine will work with a condenser, the circulating pump for which is driven by a small three-phase motor through single-reduction gears. A peculiarity of this generator is that it will be capable of delivering both single-phase and three-phase currents at the same time, in any desired proportion.

Alongside of the Helios Company's exhibit there will be erected a vertical engine and dynamo by the Siemens & Halske Company, so that interesting comparisons can be made of the two systems of central station design.

A special despatch of Sunday last from Paris says than an examination of the condition of the exposition works shows that the

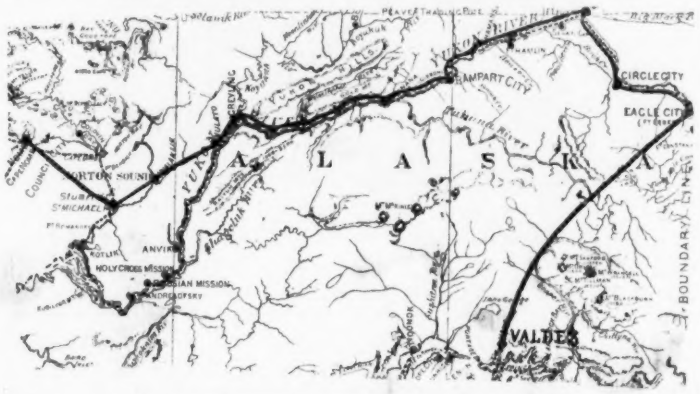
Americans should be satisfied with the progress of the American section compared with that of other countries. The façades are nearly completed in the manufacturers' and agricultural departments, and work has begun on every American section, while even France has not yet done any of this construction in most of her space.

United States Commissioner Peck is busy this week pushing matters forward. He said that some of the buildings cannot be ready before the date set for the opening of the exposition for installation of exhibits, and some departments will be incomplete for weeks after that date, but the exposition will be formally opened as announced.

The cargo of the United States auxiliary cruiser Prairie is arriving at the rate of twenty carloads daily. They are unloaded as fast as they arrive, and there is no congestion such as occurred at the Chicago Exposition. Much uneasiness, however, is felt at the non-arrival of the steamer Pauillac, which bears a number of important exhibits.

Telegraphic Development in Alaska.

Although the public has become familiar with the story of mining development in Alaska, it occasions surprise to learn that for purposes of telegraphic communication with that region the governments of the United States and Canada are now preparing to spend close upon a million dollars. The Dominion has already appropriated $350,000 to connect its stations in the Klondike telegraphically with Quesnelle, but this affords no facilities for the U. S. commanding general and the army appropriation bill reported to the House of Representatives by the committee on military affairs embodies an item of $450,000 for this very important work. It is said that construction will begin in April, it being imperative to begin as soon as possible on account of the shortness of the summer.



MAP OF PROJECTED TELEGRAPH LINES IN ALASKA.

We present herewith a map furnished us through the courtesy of Capt. G. O. Squier, U. S. V. Signal Service, showing the Alaskan line as projected by Gen. Greely, Chief Signal Officer. In speaking of the plans, Gen. Greely said recently that the growing commercial importance of Alaska and the prospective future of that country, as indicated by the best experts, show conclusively that a system of communication for the war department should be undertaken at once for the proper control and economical administration of this district. It is thought that the area can be controlled with a much smaller military force and therefore much more economically and efficiently by a proper system of communication between isolated forts. In making estimates, however, for the lines difficulty is experienced, due to the very unusual condition which exists in that region. The transportation in the interior, and the impracticability of transporting and erecting poles over a large portion of the line makes it necessary to use in a large measure especially adapted insulated wire, in some sections laid directly on the ground. This largely increases the expense of the first cost of material and renders the most careful estimate that can be made largely tentative in character. Gen. Greely contemplates the usual course, the work being done by the troops, under the direction of a signal corps detachment, and the necessary transportation being furnished by the quartermaster's department.

It is believed that notwithstanding the comparatively large amount of money estimated for them, these lines are a necessity, and should be undertaken in the next open season. The department commander's headquarters, now at St. Michael, are entirely isolated from Washington seven months each year. It should be clearly understood that the greater part of this telegraphic system is an absolute military necessity, as without it the department commander cannot reach any of the posts during the critical winter period of the year.

We present herewith also an interesting table of the approximate distances to be dealt with in the proposed Alaskan telegraph system. The need for the system is even greater than when the service was first planned, as the Cape Nome gold finds have precipitated another rush to the region with consequent increased demands for regulation and communication.

TABLE OF APPROXIMATE DISTANCES.

	Valdes.	Fort Egbert.	Circle City.	Rampart.	Fort Gibbon.	St. Michael.	Fort Yukon.
Fort Egbert	350						
Circle City	520	170					
Fort Yukon	610	260	90				
Rampart	870	520	350	260			
Fort Gibbon	940	590	420	330	70		
St. Michael	1490	1140	970	880	620	550	
Cape Nome	1610	1260	1090	1000	740	670	120

It may be added, as a matter of commercial interest that the signal corps officials are asking for proposals for material and labor for deep sea cable to connect the military post of St. Michael with Cape Nome, across Northern Sound, Alaska, a distance of about 120 miles, requiring, with 10 per cent. slack, 132 miles, more or less of cable. For the manufacture of the deep sea cable, delivered on reels, f. o. b., vessel, at San Francisco, Cal.; and for the manufacture of ten miles additional of deep sea cable, delivered on reels, f. o. b., vessel, at San Francisco, Cal.

The Pacific Cable.

A special despatch from Washington of March 13 says: Representative Corliss has filed a minority report from the Interstate and Foreign Commerce Committee on the Pacific cable project, the peculiaity of which report is that it bears more signatures than the majority report in favor of the Sherman bill. The committee contains 17 members, 13 of whom were present when by a vote of 7 to 6 it was decided to report the Sherman bill, known as the cable subsidy project, and to it seven signatures were attached. Mr. Corliss, who has long advocated complete American ownership of the cable, has secured eight signatures to his minority report, four Republicans and four Democrats. Besides this, two Democrats, Adamson and McAleer, are against the subsidy feature of the Sherman bill, and rather than have that, would vote, it is said, for the Corliss bill, although they do not now sign the report in its favor. On the other hand, two of Mr. Sherman's signers prefer the Corliss bill in case the subsidy feature of the Sherman bill be eliminated.

CURRENT NEWS AND NOTES.

AUSTRALIA-AFRICAN CABLE.—Details have been arranged for an agreement between the Australian colonies and the Eastern Extension Telegraph Company for a projected cable between Australia and the Cape.

CONTROL OF ELECTRIC WIRES.—A bill has been introduced in the New York State Assembly providing that persons or corporations maintaining overhead wires shall hereafter, within cities, string wires so as to leave a clear space of twelve inches each side of the centre of poles.

TO LICENSE WIREMEN IN THE DISTRICT OF COLUMBIA.—A bill has been introduced in the House of Representatives at Washington, providing that it shall be unlawful for any person to act as an electrical wire contractor, to engage in electrical construction in the District of Columbia, who shall not have been licensed. The commissioners of the District of Columbia are empowered to appoint an electrical board.

SNOW BLOCKADE IN QUEBEC.—For the first time in its history the Quebec street railway has been tied up, having been unable to cope with the remarkable snowstorm of March 1. In some places cars were stalled in the streets and remained there throughout the entire night unable to proceed further.

THE PROPOSED AMERICAN PACIFIC CABLE.—The commander of the sea-going naval tug Iroquois, now at Honolulu, has been ordered to prepare that vessel for making a complete survey of the Midway Islands in the Pacific, one of which, Sand Island, will be used as a landing station for the proposed Pacific cable.

AUTOMATIC TELEPHONY IN FRANCE.—A special cable despatch from Paris of March 8 says: A new invention for dispensing with telephone girls and substituting automatic apparatus, thus placing subscribers in communication without an intermediary, was tested yesterday by the Minister and the telephone officials, who were delighted with the results.

THE SILENT REVOLUTION OF THE TELEPHONE.—The telephone is revolutionizing the farm business about Richmond, Ind. More than four hundred farm houses in Wayne County are connected with telephone lines, and merchants say that the country business has undergone a great change and that they are experiencing resulting benefits. Instead of waiting for a certain day in each week to come to the city to trade, the farm wife uses the telephone and the goods are delivered by one of the numerous hack lines radiating from Richmond. Business men say farmers buy more because of the telephone, and that they do without nothing on account of distance. Physicians say the telephone works a hardship on them. People do not have to expose themselves and there is less sickness.

PACIFIC CABLE.—At Washington on March 6 the House Committee on Interstate and Foreign Commerce agreed on a bill for a subsidized Pacific cable to Guam, Honolulu, Manila and Japan. The annual rate of subsidy was reduced from $400,000 to $300,000, and the subsidy is to run for twenty years. The line is to begin at a point near San Francisco, and is to be completed to Honolulu by Jan. 1, 1902, and to Manila by July 1, 1903. The cables "shall be of American manufacture and laid and maintained by ships flying the American flag; provided that if, after due advertisement, it appears to the satisfaction of the Postmaster General that a cable of American manufacture cannot be laid within the time limit herein provided, said cable may be secured from foreign markets." The Senate Committee on Naval Affairs voted unanimously to report favorably a bill looking to the construction by the government of a cable to the Philippines.

MEETING OF ELECTRICAL CONTRACTORS.—The Pittsburg Electrical Contractors' Association has called a national convention of all the branches of the organization to meet in Pittsburg March 23 for the purpose of discussing the recent combination formed by the electrical supply houses at a meeting held in New York City. The contractors believe that this combination of the supply men means an immediate advance in prices, and in view of the fact that most of the work which will be done this spring has already been contracted for, an increased cost of material would mean a great loss to them. There are in the United States over 400 electrical contractors rated by mercantile agencies at $20,000 and over. The affairs of the meeting are in charge of the board of directors of the Pittsburg branch of the organization, who are: George R. Mathieu, James Brown, C. B. Allison, J. J. Miller, J. M. G. Fullman and Albert E. Eldridge.

INTERNATIONAL ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, ARTS AND EDUCATION.—Prof. Patrick Geddes, of the University of St. Andrews, is in the United States in order to further the objects of the International Association for the Advancement of Science and Arts, the first assembly of which will be held during the Paris Exposition of 1900. The president of the association is M. Leon Bourgeois, late French Minister of Education; the British vice-presidents are Hon. James Bryce and Sir Archibald Geikie. Prof. Greard, of the University of France, is president of the French branch. A committee has already been formed in Chicago to carry on the work of the association and to co-operate with those already existing in Paris, London, etc. Similar committees are now being organized by Prof. Geddes in New York, Boston and Philadelphia. Among the members of the French committee are Berthelot, Bertrand, Mascart and Moissan. Ayrton, Lodge, Abney, Preece, Dewar and Carey Foster are members of the British committee.

DAMAGES FOR INJURING A CABLE.—Judge William K. Townsend, of the United States District Court sitting in New Haven, Conn., has awarded the Commercial Cable Company $5000 damages for injuries done to a cable by the schooner William H. Bailey. Early in January it was discovered that a cable of the company had been cut in Gowanus Bay, and the officials of the cable company learned that the schooner William H. Bailey had anchored near the point where the cable was picked up and found cut. The captain and his crew claimed that when the anchor was hauled up it was found to be so badly entangled with the cable that they had to cut it with a meat saw. Judge Townsend said that although the vessel anchored in specified anchorage grounds, and might not have been able to prevent the anchor from getting entangled in the cable, nevertheless, the vessel should have gotten free without cutting the cable. The cable company claimed that their cables in and around New York Harbor have been recklessly cut and destroyed by masters of ships, and they decided to make the present case a test one.

HYDRAULIC AND ELECTRIC TRANSMISSION.—The Pike's Peak Power Company, controlled by the Woods Investment Company, of Victor, Colo., has closed a contract for an important hydraulic and electric transmission plant. It is proposed to transmit power from Beaver Creek, about 10 miles from Victor, for the purpose of operating the mill, hoist and reduction works of the Gold Coin Mining and Leasing Company, in the Cripple Creek district. There is a total head of 2300 feet obtainable in about 6000 feet of pipe, and a water supply sufficient to develop 5000-hp. The intention is to divide the power plant into two separate units, the first unit being situated at a point affording a head of 1150 feet. The water, after passing through the first set of wheels, will be led into another pipe and thence down to the next station, 1150 feet below. The water thus does double duty. The first plant, which is now in course of construction, is supplied by a sheet-steel riveted pipe line 3200 feet in length, 29 inches diameter and varying in thickness from 3-16 to 5-16 inches. The power units consist of four 375-kw General Electric generators, running at 450 r. p. m. Each generator will be direct connected to a pair of Pelton water wheels 69 inches in diameter and of a combined capacity of 675-hp—each wheel being supplied with a deflecting nozzle. The wheels and generators will be mounted on separate base plates and the shafts will be connected by means of combination flywheel couplings.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY.—Every student before graduating from the Massachusetts Institute of Technology has to submit a satisfactory thesis. Time is allowed for this work in the second term of the fourth year. These theses afford students an excellent opportunity to perform original research work. In the course of electrical engineering a Japanese student has chosen for his subject a study of the size of wire necessary, when aluminum is used for a conductor of electricity. He is to study the relative capacity of aluminum as compared with that of copper. As the price of copper has risen so much and as the price of aluminum has fallen, the use of the latter metal has already begun to compete with that of copper in electrical manufacture. Insurance people have appointed a committee to follow the results of such tests and to make tables from them, as it is most important to know, when buildings are wired, the safe limit of the amount of current which any wire covered or uncovered may be made to carry. If the results of this thesis are satisfactory, they may form the foundation of such a table. The method chosen for determining the relative capacity of the aluminum is entirely original, and is a method in which the temperature of the wire will be measured directly while it is carrying different amounts of current; formerly this was studied by other qualities, and because the resistance of a sample wire changed, for instance, it was inferred that the temperature at that time had risen or fallen a corresponding amount. The electrical laboratories afford ample opportunities for furnishing such quantities of current as are passed through commercial wiring, except in the cases of large central power stations.

A BOER SHELL FACTORY.—The *London Electrician* says that the shell factory of the Boers recently destroyed at Johannesburg was particularly well equipped. All the machinery in the plant was driven by electric power, the machinery alone having cost $400,000.

NAVAL WIRELESS TELEGRAPHY.—The naval statements submitted to the English House of Commons speak very favorably of the Marconi wireless telegraph system and experiments. Negotiations are reported to be in progress with Mr. Marconi on behalf of the British government.

PHILIPPINES CABLE.—The Berlin *Neueste Nachrichten* states that a supplementary vote will be asked for to provide funds for a cable to Kiao-Chou, which will be joined to the American Philippine cable. The Norddeutsche *Allgemeine Zeitung* declares that this statement is inexact.

UNIVERSITY OF TENNESEE RECORD.—The University of Tennessee *Record,* in its annual number devoted to engineering, describes the electrical power distribution plant of the University shops. Other articles on electrical subjects are a description of an electric recording river gauge, on the electrolytic determination of copper, and on a photometer with a direct reading scale.

THE MORSE HOUSE in West Twenty-second street, which was occupied by Prof. S. F. B. Morse for many years, has just been pulled down. The marble tablet on its face is to be reset in the big new office building on the same site, with an additional explanatory tablet. The American Institute of Electrical Engineers at one time proposed to buy the house, but found the price prohibitive.

THE AUTOMOBILE SHOW.—Papers have been signed for the use of Madison Square Garden, in New York, during the first week in November next for the purpose of holding an automobile show under the auspices of the automobile Club of America. It will be the first exhibition of automobiles on a large scale held in this country, and it is expected that vehicles of European manufacture will be included in the exhibit. A circular track will be provided in the Garden in order to show the various types of vehicles in practical operation.

REGULATION OF GENERATOR E. M. F.—A patent was granted March 6 to B. G. Lamme for keeping constant the e. m. f. at the binding posts of a generator driven at a speed which may vary. Across a circuit is a small motor operated with a saturated magnetic field. This motor drives a small generator, the field of which is unsaturated and the armature connected in series in the generator shunt field winding. Owing to the saturated field of the motor, it will respond immediately to any change of e. m. f. due to change in speed of generator or to any other cause. Since the field of the regulating generator is working below saturation, a change in its speed will immediately effect a change in its field and therefore in the e. m. f. which it impresses upon the field circuit of the main generator.

FUSE BLOCKS FOR LARGE CURRENTS.—A patent issued March 6 to H. P. Davis describes a fuse block for circuits where the normal energy is large, the block being applicable as an auxiliary protective device in connection with a circuit breaker, or may be utilized as the sole protective device. The body portion of the fuse block, which is cylindrical in form and strongly reinforced by end plates and clamping bolts, has a lateral blow-out opening and a longitudinal fuse chamber closed at each end by removable fuse terminals. The fuse is itself provided at each end with a terminal piece, and the two ends of the chamber beyond the fuse are filled with a loose packing of asbestos. When the fuse blows, the force of the explosion is partly spent through the blow-out opening, but at the same time sufficient pressure is exerted to pack the loose filling in the tube into a compact mass, which fills the parts constituting the removable fuse block terminal, thus protecting it from injury.

ROUTE FOR PACIFIC CABLE.—Admiral Bradford, Chief of the Equipment Bureau, has received the report of Commander Hodges, of the Nero, upon the survey made by that vessel of the Pacific Ocean to find a practicable route for a submarine cable from California to Honolulu, Guam, Midway Island, Luzon and Yokohama. The officer reports that his survey developed a route for the cable eminently satisfactory and thoroughly practicable. The currents of the Pacific are extremely variable and erratic, and subject to a tidal influence, especially in the vicinity of reefs and islands, so that very careful navigation is necessary, especially from the Hawaiian Islands to Midway. A strong current of one to two knots an hour setting with the wind frequently changed to nothing in light weather in a single day. From the day of sailing from San Francisco, April 22, 1899, to the date of return, Feb. 11, 1900, the ship steamed 29,283 knots, and Commander Hodges declares that a cable route was never so extensively and thoroughly surveyed and developed. The two deepest temperatures ever taken were recorded. The depths are 5160 fathoms and 5269 fathoms, and the temperatures are 35.9 at 5070 fathoms and 36 at 5101 fathoms.

TO REGULATE AUTOMOBILES.—Assemblyman Apgar has introduced in the New York Legislature a bill to regulate the operation of automobiles. It provides that no person shall operate a motor without a license granted by a local examining board of persons charged with the inspection of boilers or the passing upon the qualifications of engineers, a fee of $1 being charged for the examination. This examining board is to examine the persons applying for the license, inspect, examine and test the motors, and, if the person is found competent to operate the motor without injury to the public and if the automobile be found in a safe condition, they shall issue a license, upon the payment of $2 for each vehicle. This license shall fully authorize the holder to run and operate the motor carriage through, across and upon all public highways, streets, and parks of the state for a period of one year. The examining board may, upon five days' notice of its intention revoke or suspend for the period of six months any license issued by it, upon satisfactory proof of drunkenness, incompetency or reckless driving. Another license may not be issued to a person whose license has been revoked within three months of the revocation. This is a fair example of the legislation now being proposed in many states.

LIGHTNING AND THE ARC LIGHT.—In a letter to *Nature*, Mr. Sidney Webb contributes some remarkable photographs which appear to indicate that simultaneously with lightning flashes, electric discharges take place between an arc lamp and the ground. Commenting upon the phenomena presented by the photographs, Prof. G. G. Stokes says that several theoretical questions present themselves. Do the lamps act merely in consequence of the tall iron lamp post, so that the effect would be the same if the lamps were not supplied with current? What is the nature of the action of the flash of lightning in bringing about the discharge? What determines the course of the discharge and why is it so different from flash to flash, while for a given flash it is nearly the same for lamps ranging over a space of some hundreds of yards? What is the nature of the beading or striation of the discharge? As to the first query, Prof. Stokes' answer is that he thinks the electrical action of the lamps is required to produce the phenomenon. When the lamps are in use there is a steep gradient of electrical potential about them corresponding to their working pressure of 50 volts. If then something occurs to cause a sudden change of potential gradient irrespective of the lamp, this compounded with the normal gradient due to the lamp, would give in some places a greater and in some places a less gradient than the normal. A path might thus be opened for the discharge which may go to the ground provided there be sufficient gradient to continue it when it had gone to a distance from the lamp. As to the striation and beading presented, an explanation as to the latter is that it might have something to do with the way in which the path crossed a series of electromagnetic waves like those of light except as to wave length. Another explanation which seems more probable is that they are of the nature of the striated discharge in exhausted tubes. A more general view is that the phenomena depend on electromagnetic waves propagated from the flash. The flash would take the place of the sending instrument in wireless telegraphy, the resisting air that of the coherer, the gradient of potential, whether artificial and due to line current or natural as existing in thundery weather, would take the place of the e. m. f. of the battery or cell which tends to send the current through the coherer, while the electromagnetic waves would open a path for the current in the air as in the coherer. Though possibly not related to the above phenomena, it is interesting to recall the fact recently reported at a meeting of the A. I. E. E. by Mr. W. J. Clarke, that the sparking accompanying the passage of electric railway cars around a curve, strongly affected a wireless telegraphy outfit some distance away.

STREET RAILWAY ENGINEERING.—Mr. Edw. P. Burch, of Minneapolis, Minn., will give an illustrated lecture before the engineering students of Nebraska University March 21, on the subject of "Heavy Street Railway Engineering."

NEW ENGLISH CHANNEL CABLE.—The cable steamer Britannia, of the Telegraphic Construction Maintaining Company, of London, arrived of Cape la Hague, France, on March 13, and was successful in landing the cable for the Anglo-American Telegraph Company, of London. The cable goes from Cape la Hague to Crickmere, near Newhaven.

A CALIFORNIA TRANSMISSION PLANT.—The Truckee River General Electric Company has completed its dam in Floriston, Cal., and will soon supply electric power to the Comstock mines. Worw is well advanced on the pole line. The poles are of hard redwood and are from 30 to 40 feet in height. There will be two circuits of No. 4 copper wire, with glass insulators.

THE TELEPHONE A LEGITIMATE MEDIUM OF TRADE.—At Uniontown, Fayette County, Pa., a coke suit involving the legality of a contract made over a telephone was decided the other day, making the telephone a legitimate medium of trade. It is said that this is the first time that question has been brought into court, and the decision is therefore considered important.

THE RECENT BLIZZARD IN ST. LOUIS.—The heavy snow storm and blizzard of Feb. 27 did an enormous amount of damage to electric light, telephone and telegraph properties. The street car service on many lines was paralyzed part of the time. Many horses were killed by coming in contact with fallen wires; the lights were out during the night and there was general suffering everywhere throughout the city.

STEVENS STUDENTS AT THE WESTINGHOUSE WORKS.—A party of thirty-five students from the Stevens Institute of Technology, Hoboken, N. J., under the guidance of Professors J. E. Denton and A. F. Ganz, were in Pittsburg for several days last week visiting the Westinghouse plants at East Pittsburg. They were especially interested in the 1500-hp gas engine now in course of construction at the works of the Westinghouse Machine Company.

WIRELESS TELEGRAPHY ON ATLANTIC LINERS.—The steamer Kaiser Wilhelm der Grosse, of the North German Lloyd steamship line, has been equipped with Marconi wireless telegraph apparatus. When the ship was about 50 miles north of Borkum Island in the North Sea, on her last trip to New York, messages were successfully transmitted ashore. It is stated that the experiment was satisfactory and that all the swift ships of the line will use the wireless system to announce their proximity to the coast, not only in Europe, but on this side of the water.

TURRET ELECTRIC MOTOR CONTROL.—In a patent issued March 6 to M. W. Day, an improvement is introduced into the Ward Leonard system of motor control whereby the operating resistances and switches are enabled to be placed by the generator instead of in the turret, thus avoiding the necessity of carrying heavy currents to the controller, and permitting one or more motors to be controlled from any number of selected points. The rheostats and switches are controlled by electromagnetic means from one of more master-controllers located near the driven mechanism.

PARIS SCIENTIFIC CONGRESSES.—Following is a list of congresses arranged to be held in connection with the Paris Exposition, dealing with subjects having a bearing on electrical engineering: Testing of Materials, July 9 to 16; Applied Chemistry, July 23 to 31; Physics, Aug. 6 to 11; Mathematics, Aug. 6 to 11; Electricity, Aug. 18 to 25; Steam Engines and Machinery, July 16 to 18; Applied Mechanics, July 19 to 25; Tramways, Sept. 10 to 12. The joint meeting at Paris of the American Institute of Electrical Engineers and English Institution of Electrical Engineers will immediately precede the Electrical Congress.

ELECTRICAL MEASURING INSTRUMENTS.—Two patents were issued on March 6 to A. H. Hoyt on electrical measuring instruments, one of which is intended particularly for use with electric automobiles, for measuring both the voltage and amperage with a single instrument. Two concentric scales are used and but a single magnet. In connection with this magnet two fields are formed by a proper arrangement of pole pieces, one of which is a field for the voltmeter movable element, and the other a field for the ammeter movable element. The second patent relates to the details of construction of the field element of ammeters and voltmeters, and means for conveying the actuating current to the movable element.

PROGRESS OF THE PAN AMERICAN EXPOSITION.—At a recent meeting of the Directorate of the Pan American Exposition the Exhibits Department was organized. It will be divided into the following departments: Electricity, graphic arts, liberal arts, ethnology, agriculture, horticulture, live stock, forestry, mines, machinery, manufactures, transportation exhibits, and the Hawaiian, Puerto Rican, Cuban and Philippine exhibits. Each division will have a superintendent at the head, who will be directly under the control of the Director General. Work on the exposition grounds is practically at a standstill, although the force of men in the Service Building is kept busy planning duct lines, railroads, bridges, transformers and conduits for the electrical power. The designs for the entrances have been completed.

THE RAPID TRANSIT TUNNEL.—It has been decided to formally begin the construction of the underground rapid transit tunnel, New York City, at 2 o'clock, p. m., March 24. The event will be celebrated with some ceremony, the plans of which, however, have not yet been given out. An "assignment of lease" has been filed in the county clerk's office. The document passes between Mr. John B. McDonald, the contractor, and the Rapid Transit Construction Company, in consideration for which the latter provided sureties for the contractor and otherwise agreed to finance his undertaking. The company is to receive all money payable to Mr. McDonald under the tunnel contract and disburse it, and he is to make no sub-contracts for any portion of the work, or for the purchase of any materials, until they shall have been approved by the company.

ELECTRICAL FITTINGS.—The National Board of Fire Underwriters has ready for distribution the January, 1900 (quarterly) edition of the supplement to the National Electrical Code, containing a list of electrical fittings examined and approved by the National Underwriters' Electrical Association for use under the rules and requirements of the National Board of Fire Underwriters for the installation of electric wiring and apparatus. All the devices and materials listed have been tested in the Electrical Bureau of the National Board of Fire Underwriters, which is in charge of W. H. Merrill, Jr. In the introduction of the pamphlet it is stated that while some of the articles listed are not entirely reliable, they are the best at present obtainable, and must necessarily be used until more satisfactory devices are put on the market. The Electrical Bureau invites manufacturers to send for test, with a view to listing, electrical appliances judged to be suitable for general use.

TWO-PHASE MOTOR CONTROL.—A patent issued March 6 to B. G. Lamme describes a means to reduce the starting torque and current of a two-phase motor by varying the connections between the motor windings and the service conductors. By varying the connections as described below, the motor windings may be supplied with full service voltage, seven-tenths service voltage or half service voltage, thereby reducing on light load the exciting watts in these ratios while the working watts remain constant. Let A and B be the conductors of one side of a two-phase circuit, and B and C those of the other side. Then if one motor winding is connected between A and B and the other between C and D, the two windings will be subjected to the full voltage of the circuit. If, however, the motor windings are connected respectively to A and C, B and C, D being unconnected, they will be subjected to but seven-tenths of the full voltage. If, now, a fifth service wire, N, be run from the neutral point of an open coil generator winding, or from a wire connecting the middle points of the secondaries of the two transformers of a two-phase circuit, the windings will be subjected to but half the full voltage if connected with C and N, B and N, respectively, A and D being unconnected. By means of a switch, any one of these three connections can be made at will.

MR. TESLA'S LABORATORY IN DANGER.—One day last week the building on East Houston Street, New York, in which Mr. Nikola Tesla has his laboratory, was damaged by fire. The flames, however, were confined to the basement and did not reach Mr. Tesla's quarters. It will be remembered that Mr. Tesla's laboratory on South Fifth Avenue was burned out a few years ago.

NEWARK INDUSTRIAL EXPOSITION.—It is proposed to hold an industrial fair in Newark, N. J., in 1902. The *Evening News* of that city is promoting the enterprise, and invites the co-operation of capitalists, manufacturers, merchants, professional men and public officials of the city and state to make the exposition a success. A similar exposition was held in Newark in 1872, with successful results.

INDUCTION COIL FOR ROENTGEN RAY APPARATUS.—A patent was issued March 6 to Prof. R. A. Fessenden on an improvement in the construction of induction coils for use in producing Röntgen rays. The inventor states that for the best results the ratio of the length of the core of an induction coil to its diameter should be at least as 30 to 1. With such a ratio the time-constant of a coil may be much reduced, thus allowing it to be magnetized more quickly. The iron core is wound continuously with the primary coil as usual, and secured in a vertical position inside of an insulating framework. The secondary coils are in separate sections and, as illustrated, are separated from each other by about twice the length of each section.

ELECTROLYTIC MANUFACTURE OF METALLIC CARBONATES.—In a patent granted March 6 to J. W. Richards and C. W. Roepper, a process is described for the electrolytic manufacture of white lead and other metallic carbonates. The process is based upon the fact that certain substances such as acetic acid can be split up by electrolytic action and the carbonic acid thus generated placed in such relation to a metal anode as to form a carbonate therefrom. In producing white lead by this process a solution consisting of acetate of sodium and sulphite of sodium is used in the proportion of ten grams of the former to one-quarter gram of the latter per liter. With this electrolyte a lead anode is employed, the cathode being of carbon. A very slight addition of nitrate of potassium is made to counteract any effect from liberated nitric acid. A current of one to two hundred amperes per square meter of anode surface is used.

FRANCHISE HEARINGS have been conducted by the New York States Tax Commission during the past week when local lighting and railway companies have argued against the excessive valuations placed on their properties. One of the interesting points raised by the Commercial Cable Company, as well as by the Western Union, is that their franchises have been granted by the national government and are not therefore subject to this state tax. The state could not give to the telegraph company a franchise to erect its lines and transmit telegraphic messages. Privileges to use roadways, after being granted by the national government, must also be granted by the owners of abutting property along such highways. Nothing comes from or can be granted by the state to a telegraphic company. It is held also that the franchise tax law is unconstitutional, because it provides for unequal taxation and because it is vague in its provisions. It is argued that the statute is unconstitutional, if not that it does not apply to telegraph companies, and that if it does the assessments made on the franchises of the company far exceed their actual value.

ELECTROLYTIC INCANDESCENT LAMP.—Two patents were granted March 5 to John Van Vleck and a third patent jointly to Van Vleck and W. N. Stevens, on automatic methods for establishing a flow of current through the refractory material of an electrolytic incandescent lamp, which material is a non-conductor at normal temperature, but upon being heated to a certain point becomes a conductor, and thus is rendered incandescent by the passage of the current. In one patent a filament of carbon is disposed in close proximity to the rod of refractory material. When the lamp is cut into circuit the current passes through this filament, the heat of which by radiation heats the refractory rod; when the latter is heated to such a point as to become a conductor, the filament, by means of a solenoid, is cut out of circuit. In the second patent a switch on the socket is first turned to throw in the heating element; when the heat from the latter brings the refractory material up to the temperature which causes it to become a conductor, another turn of the socket key throws the heating element out of circuit. In the third patent the heater consists of a gas burner, the jet from which is electrically ignited when the lamp is started up and the gas automatically turned off after the refractory element becomes conductive and incandescent.

A BUDGET OF PATENTS.—Among the patents issued March 6 were four to Mr. Lyman C. Reed and five to Warren B. Reed and Lyman C. Reed jointly. The first mentioned patents relate to a system of electrical distribution and to an automatic circuit breaker to be used in connection therewith. The first patent of the series provides for the protection of a system of electrical distribution by the grounding of the neutral wire of a three-wire system through a circuit breaker, the circuit breaker being thrown in operation by a solenoid transformer, the primary of which is in the ground circuit. The second patent of the series relates to the application of the protective system to two-wire distributing circuits, in which case the circuit breaker and solenoid transformer are connected with one of the two legs of the system. The third patent is on the details of the above circuit breaker. A solenoid transformer blows the starting fuse, which releases the switch of the circuit breaker and opens the ground circuit. The fourth patent is on the application of the protective system to alternating current circuits. Of the five patents issued jointly to Warren B. and Lyman C. Reed, the first in date of application is on an underground system of electrical distribution in which the neutral conductor cable of a three-wire system of distribution is dispensed with and the metallic sheathing of the cable is utilized in its stead. The sections of sheathings are permanently bonded and grounded at all available points of the system, thereby producing a neutral equal in practical effect to one of infinite capacity. The second patent is on the application of this principal to overhead wires, the third to the series arc system of electrical distribution, the fourth to alternating current transmission and distribution, and the fifth to electric railway feeders. In the latter case the sheathing, highly insulated from the interior conductor, is grounded at every available point and connected to the rails wherever practicable.

TELEPHONE PATENTS.—Three patents in the branch of telephony were issued March 6—one on a telephone system, another on selective signals for telephone circuits and a third on a telephone transmitter. The first-mentioned patent, issued to J. W. Gore, relates to party line circuits, and provides means whereby the several sections of the same line can be used simultaneously without interfering with each other. A switch in connection with the main and return lines has a movable part and a series of contact fingers; on the movable part are secured four insulating conducting strips, having the main line connected with two of them and the return line connected with the other two. The signaling device is connected in circuit with two of the fingers, and the local telephone circuit with the remaining fingers. When the switch is turned, one side of the main line will be closed from the signaling device and one side of the return line; and the other side of the main line closed from the local telephone circuits, and the other side of the return line. Means are provided for operating the disk and for limiting its movements in both directions. The second patent was issued to G. K. Thompson, and relates to a selective signal system wherein plus or minus currents are employed for either or both conductors of both circuits; the receiving device of the several stations being connected in branches to the earth from the main conductors. Permanently connected earth branches have heretofore been exclusively employed, which has made it impracticable to arrange a four-station metallic circuit for operation on the common battery system. The patent provides a bridge containing a condenser and a relay responsive to a particular intermittent current, during the passage of which the relay armature is steadily attracted. The armature controls the normal disconnected earth branch, which is connected with the main circuit conductor during the attractive period of the armature. A polarized bell has its magnet in the earth branch, its armature moving in one direction with each omission, and oppositely with each intermission, of the current. The telephone transmitter patent describes a means for preventing the packing of the granular carbons of a transmitter. The motion of the hook lever of the transmitter is utilized to shift the relative positions of the granules by working a ratchet which gives motion to an axle having mounted on it the transmitter proper.

THE ASSOCIATION OF ENGINEERING SOCIETIES.—The report of the secretary of the Association of Engineering Societies for the year 1899 shows a high degree of prosperity, flowing, doubtless, from the fact that the Association rests upon a sound business principle, that of combination and concentration of effort for a single purpose—viz., the proper and economical publication of the papers and proceedings of the several societies composing it. The aggregate membership of the societies composing the association, which increased from 1174 to 1477 during 1895, and was then reduced to 1106 by the withdrawal of the Western Society of Engineers, has since steadily increased again, until at the close of 1899 it had practically made good the loss so caused. The geographical limits of the association now extend from the Atlantic to the Pacific, and from Montana and the Great Lakes to the Gulf of Mexico; so that the pages of its *Journal* represent the practice of nearly all the widely differing sections of the Union. This is well illustrated in the January issue, in which appears a paper from the Cleveland society upon dock equipment for the rapid handling of coal and ore on the great American lakes, one from the St. Paul society describing the removal of portions of a bridge crossing the Mississippi at that place, one from the Louisiana society upon the progress of drainage in New Orleans and one from the Detroit society upon masonry construction, earth pressures, etc. Notwithstanding a steady decrease in the annual assessment upon the members, the net assets of the association steadily increased from a deficit of $759 at the end of 1894 to a surplus of $2937 at the end of 1898, when a rebate of $1 was made from the assessment of $2 for the express purpose of reducing the surplus, as the object of the association is not to accumulate a large and nearly idle surplus, but to give to its members the best possible service at the least possible cost. The gross cost per annum per member has steadily declined from $4.92 in 1894 to $2.19 in 1899, while the annual assessment per member, which was increased from $3 to $3.66 in 1895, was steadily reduced to $2 in 1898 and (by a rebate of $1) virutally to $1 in 1899. The association, by virtue of its much greater membership, not only provides the members of its societies with far more material, and gives to that material a very much wider circulation, but also proves itself a vastly more economical and efficient means of publication than any individual society, with relatively small membership, can hope to provide. Some years ago, when it was considered advisable to solicit the co-operation of societies still outstanding, the association was confronted with the fact that such co-operation, notwithstanding its admitted advantages, involved, in the cases of some societies, an increase in the charges upon its members. This is no longer the case, as the association not only gives much better service than individual societies, but gives it much cheaper. Another objection sometimes urged by outstanding societies is that membership in the association means loss of identity by reason of the merger of their publications with those of other societies in the *Journal* of the association; but any society in the association, and prizing such identity, can secure it at a trifling cost by having its own papers and proceedings reprinted separately, using the type from which they have been printed for the *Journal* of the association.

LETTERS TO THE EDITORS.

A Curious Switchboard Phenomenon.

To the Editors of Electrical World and Engineer:

Sirs:—The letter from Mr. Bellman in your issue of March 3 explains the action of electrostatic charges on the terminals of the Postal Telegraph switchboard in a very satisfactory manner. But it would seem to be unnecessary to go so far in search for the cause of this electrostatic charge as to implicate the generator.

It has been my experience that certain circuits in a network of wiring will receive a much heavier electrostatic charge than others, due probably to proximity to belts, more perfect insulation from "ground" or lack of opportunity to discharge to ground or some other circuit.

The exact cause is sometimes hard to locate, but I would prefer to assign some simpler cause for this curious phenomenon than the dissymmetrical winding of the generator, as electrostatic charges are often present in circuits entirely disconnected from any apparent source of e. m. f.

The electrometer test suggested by Mr. Bellman will be a quite certain method of determining the source of electrostatic charge, provided the circuits are tested both connected with and disconnected from the generator.

FRANK H. GAGE.

BATTLE CREEK, MICH.

(Neither the explanation of Mr. Bellman nor that of Mr. Gage accounts for the collection of dust on the plus 85-volt discs of one section of the board and not on the plus 85-volt discs of the other section, the discs being connected to the same generator; nor why there should be dust on the minus 85-volt discs of the last-mentioned section and none on the minus 85-volt discs of the former.—EDS.)

Short-Circuit Curve of Alternators.

To the Editors of Electrical World and Engineer:

Sirs:—I have read the letter of Mr. B. A. Behrend in your issue of January 27, relating to a criticism made by Mr. Rothert and myself in the *Elektrotechnische Zeitschrift*, 1899, page 894, of a paper by Mr. Behrend, appearing on page 838 of the same journal. The paper related to the drop of tension in alternators and pointed out the superiority of the Behn-Eschenburg method over the method of Rothert with respect to an inductor type generator.

The clause, "In which we do not observe the leakage of the lines of force, which would complicate the method in such a way that it would be of no value for practice," attracted my attention, and led me to point out to Mr. Behrend that in a machine where almost everything is leakage, as in an inductor type generator, leakage must be taken into account, else, even with the most ideal theory, we will most probably arrive at entirely valueless results. In the Behn-Eschenburg method, leakage is included in the term "self-induction" and therefore need not be separately considered. This method, therefore, gives excellent results for machines with a low armature reaction, and the average inaccuracy through using the Behn-Eschenburg method in the example given is only 5.5 per cent.

This criticism gives Mr. Behrend just reason for a reply, since I only mentioned the inductor type of machine, and not the revolving field type, which he also considered. But I only referred to the example of the inductor type generator for the reason that it seemed to prove his statement with respect to leakage. The other example, however, of the alternating pole type, to which he draws my attention in his letter, disproves his own statement.

The inaccuracy in using the Behn-Eschenburg method is —20 per cent. to —35 per cent., while the inaccuracy in using the Rothert method is + 7.8 per cent. to + 12 per cent. Therefore (without our considering the leakage), the inaccuracy of the Rothert method is only one-third of the inaccuracy of the Behn-Eschenburg method. Considering furthermore, that Mr. Behrend tested this machine with 29 amperes, or half the short-circuit current, the leakage for such a machine of 6 kilowatts with 1 mm airspace will easily amount to 5 to 10 per cent. As Rothert's method, without considering the leakage, gives an inaccuracy of + 7.8 to + 12 per cent., it will give, when we take the leakage into account, an inaccuracy of about zero. Therefore, it seems to me that this type of machine serves as an excellent illustration of the superiority of the Rothert method over the Behn-Eschenburg method.

With this I wish to close the discussion of the above matter, even if my criticisms are not accepted by Mr. Behrend. As to the other statements not concerning electrical matters, but dealing in personalities relating to Mr. Rothert and myself, I do not think that answer should be made in the columns of a technical journal.

CHARLEROI, BELGIUM. ALEXANDER HEYLAND.

To the Editors of Electrical World and Engineer:

Sirs:—Referring to the latter of Mr. B. A. Behrend in your issue of January 27, the first and most essential part of this letter I shall not consider here because I cannot reasonably expect your valuable journal to give space to personalities.

As regards, however, Mr. Behrend's concluding remark, which is of a technical nature, I am glad to say a few words in reply. It is true that I have, through a private letter from Mr. Behn-Eschenburg, discovered an error in my paper, but this error is of no special importance, even though, in the example cited by me, it shows the Behn-Eschenburg theory in a more unfavorable light than is consistent with truth.

I can here only repeat, as has been done more than once in the *Elektrotechnische Zeitschrift*, that the incorrectness of Behn-Eschenburg's theory and its lack of agreement with the results of

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experiments are what led me to introduce a new conception and to test its correctness. This conception of mine has proved highly serviceable to me in the designing of many hundreds of generators, for, unlike Behn-Eschenburg's conception, it permits us also to take into account in advance the leakage and magnetic saturation of the machine to be designed.

Those of my experiments which were made somewhat carefully, are published in my last paper. I believe that the examples cited therein speak for themselves, even though they were carried on without regard to leakage or saturation. If these were considered the results would be still more favorable. It must be admitted that it is exceptionally difficult to take into account in these experiments the leakage and magnetic saturation; for this reason machines should be chosen in which leakage and saturation are slight. It is different with the calculation in advance of the generators, in which it is very easy to consider these two factors, but hardly possible to use the Behn-Eschenburg method. The calculation of machines made possible by my method is a rational one, and takes into account, as far as possible, all influences.

Mr. Behrend has failed to understand the signification of my method in so far as he tests it, as he himself expressly states, *without regard to leakage and saturation* in the case of machines which, of all known types, have the greatest leakage; and in which saturation manifests itself in the most undesirable and least controllable manner—machines that are, therefore, least adapted for the checking of my method.

The single example of a machine of small leakage cited by Mr. Behrend is the very one to invalidate his assertion, and speaks in favor of my method. This example would naturally produce still better results if the leakage were taken into account.

I hope that the controversy is herewith ended, the more so since it was begun by Mr. Behrend in a form to which I am not accustomed in techincal discussions. ALEXANDER ROTHERT.

FRANKFORT-A-MAIN, GERMANY.

DIGEST OF CURRENT ELECTRICAL LITERATURE.

By CARL HERING.

DYNAMOS, MOTORS AND TRANSFORMERS.

Friction of Induction Motors at No Load.—BLANC.—An article in which he agrees that Braun's formula (Digest, Nov. 4) is practical for rapid, approximate determinations. He describes another method, in which an inaccuracy of Braun's method is obviated, which, however, is applicable only to motors with slide rings. He determines the friction at no load from the slip at no load and the armature loss at no load; the latter is measured as the square of the e. m. f. induced in the armature at no load, divided by its resistance. For determining the slip he uses a small compass of 0.4-inch diameter, as often worn on a watch chain; he says that it is easy to determine up to 200 periods per minute with great exactness, and up to 300 periods after a little exercise and with less precision. He claims that such a compass is a more useful and practicable instrument for determining the slip, than the best revolution counters. He remarks that his method can be used also for single-phase motors, and gives an approximate formula, which may be used to advantage by designers for motors of 0.1 to 300-hp. The friction at the shaft in watts is equal to a numerical factor multiplied by the square root of the product of the power of the motors in horse-power and the diameter of the armature in centimeters. The numerical factor depends upon the construction of the shaft bearing and varies between 20 and 30; it is quite constant value for machines and motors of equal type and similar construction of the shaft bearing.—*Elek. Zeit.*, Feb. 15.

Transformers With High Core Loss.—WAGNER.—A comparison of the merits of transformers having equal efficiencies at their rated load, one having a much higher iron and lower copper loss than the other. For cases where the load is always maintained at a high point and occasionally reaches considerable overloads the writer points out the fact that the transformer with the high core and low copper loss is far preferable, as the efficiencies on the overloads are higher and the total heating increases much more slowly, giving a great overload capacity.—*Amer. Elec.*, March.

Synchronous Converters.—SIMEK.—A communication stating that he has made experiments similar to those of Herrmann (Digest, Feb. 17). He states the principle, as follows: the e. m. f. induced in the armature of a dynamo is produced by the relative motions of the armature and the magnetic field, which can be accomplished either with a stationary field and a rotating armature or with a stationary armature and a rotating field; a modification of the latter case is to have stationary armature and field coils, and to produce a rotary field by supplying the field coils with a polyphase current. In the last method, if the armature is an ordinary continuous current armature, ordinary alternating current is taken from the brushes, so that the machine converts polyphase current into single-phase current. If, however, the brushes are revolved synchronously with the rotary field so that they always have the same position with respect to the field, continuous current is taken from the brushes. Preliminary experiments with a small machine of this kind were successful, but a practical application has not yet been made.—*Elek. Zeit.*, Feb. 15.

REFERENCES.

Non-Synchronous Motors.—HEYLAND.—A communication modifying slightly the graphical representation given in the article of Heubach (Digest, Feb. 24) so that the diagrams appear in a more convenient form.—*Elek. Zeit.*, Feb. 15.

Double-Wound Armatures.—ADAMS.—An analysis of the conditions of direct-current machines having two windings on their armatures, such as are commonly termed "dynamotors." The capacity of these machines with the same field and armature core wound with a single winding, is compared for various conditions, such as working as a motordynamo, as a two-speed motor, or as a double-wound generator.—*Amer. Elec.*, March.

Rotary Converter.—BROCKSMITH.—A complete design and working drawings for a 1-kw combined alternating and direct-current machine which can be used as a rotary converter, direct-current generator or motor, or alternating-current generator or motor, either single, two or three-phase. The design provides a starting switch for starting the machine from single-phase alternating current.—*Amer. Elec.*, March.

LIGHTS AND LIGHTING.

Arc Lighting From 250 Volts Supply.—MACLEAN.—An abstract of a paper read before the Glasgow section of the British Inst. of Elec. Eng. He pointed out the unsuitability of 250 volt supply for arc lighting except where the number of lamps was five or multiples of that number. The consumer who requires a small number of lamps is almost forced to adopt enclosed arcs with their relatively poor light for a given expenditure of energy. He has made some experiments to determine the relative light-giving qualities of the various sources of electric illumination. The enclosed arcs had both inner and outer globes of opal glass, the open had an opal globe, while the incandescent lamps were new ones. For open arc the number of lamps was five in series, the resistance in series 4 ohms, the current 10-amp. power per lamp 100 watts; for enclosed arcs, two in series, 12 ohms, 4-amp. 500 watts; for a single enclosed arc without resistance 2.75-amp., 680 watts, for 16-cp incandescent lamps 16 lamps, 4.4-amp. 500 watts; for 8-cp incandescent lamps 31 lamps, 4.5-amp. 500 watts; for these different sources of light the relative amount of illumination, taking open arcs as 1, is 1, 0.375, 0.01, 0.31, 0.33, and the relative amount of illumination, taking 16-cp lamps as 1, is 3.75, 1.54, 0.325, 1, 1.07. A method of supplying a small number of arc lamps economically from a 250 volts supply, is to use a "gauzer switchboard" which has been used by Langdon for lighting some railway station waiting rooms; this, however, solves the problem only partly, as at least five lamps must be used on any particular circuit. A small synchronous converter, transforming from 250 volts to 50, is said to be by far the better plan. Considering that alternating current supply companies have to put their meters on the low tension side, he thinks that the continuous current supply should do the same, thus eliminating the converter losses from the consumers'

bill. This is all the more desirable, as the 250 volts supply was introduced solely for the benefit of the supply authorities.—Lond. *Elec. Eng.*, Feb. 23.

Miners' Lamp.—WALKER.—An article calling attention to the well known disadvantages of secondary batteries for that purpose; the lead oxide scales off and chokes up the intermediate space between the plates; packing the intermediate space with porous material only introduces fresh complications; there is always the risk of the light failing when most needed. He regards the use of primary batteries as essential under existing conditions; they should have a single fluid, be simple and strong in construction and easily examined.—Another article showing that the electric glow lamp is superior to the ordinary miners' safety lamp, in that it is calculated to greatly reduce the danger of accident from explosions of fire damp and coal dust, falls of roof and entanglement in underground machinery. The energy required to cause the ignition of ordinary coal gas issuing from a burner is said to amount to at least 20 watts, whereas the electrical energy delivered by a 1-cp glow lamp is only 4 watts. While the ignition of an explosive gaseous mixture may be effected by a copper wire at dull red heat, the surface of the heated body and the energy of the current, especially when in the form of a spark, have a preponderating influence, since each gas molecule forming a centre of combustion also is a centre of radiation of heat, and ignition only occurs when heat is applied more rapidly than it can be dispersed by radiation; but as the glowing filament is very small, the electric lamp is incapable of causing damage if broken, in fact less so than the ordinary safety lamp with its comparatively large surface of metallic gauze, liable to become red hot.—*Colliery Guardian*, Vol. 78, p. 592, 493; abstracted in *Brit. Inst. Civ. Eng. Abstracts*, Vol. 139, Part 1.

REFERENCE.

Three Arcs in Series.—GOSSELIN.—His paper in full, with the full discussion which followed, an abstract of which was noticed in the Digest Feb. 3.—*Bull. de la Soc. Int. des Elec.*, December.

POWER.

Steam Turbines.—A complete account of the work which the Westinghouse Machine Company has been doing in the development of the steam turbine of the Parsons type in America. Drawings and views are given of a 500-hp turbine direct coupled to a two-phase 300-kw alternator. Three of these machines are now running in the power plant of the Westinghouse Air Brake Works. The turbines run at 3600 r. p. m., the 60-cycle alternators being bipolar. The complete weight of these sets is 25,000 lbs. The steam economy is extremely high, varying from 16 lbs. of water per electrical horse-power hour at full load condensing, to 22 lbs. at one-quarter load. A brief description is given of the methods of expanding the steam, governing and preventing vibration. The article contains also the drawings of a 2500-hp set being built for a New York lighting company; this machine weighs 200,000 lbs.; its speed is 1200 r. p. m., the generator having six poles and delivering 60 cycles per second.—*Amer. Elec.*, March.

Protection of Electric Power Transmissions Against Lightning.—MORRIS.—The conclusion of his illustrated paper (Digest, March 3). He discusses the methods for making earth connections of the lightning arresters. The lead from the arrester to earth must be as short and direct as possible; sharp bends should be avoided, and the lead must on no account be formed into a coil. For lines along which the power is transmitted with continuous currents, as for electric traction, reactance coils are frequently used in such a way that an arrester is connected just before each reactance coil, to give the dangerous discharge an easier path through the arrester to earth than it would have by forcing its way through the reactance coil, and so on by the line to the station. For simple power transmission circuits, where the power is generated at one end of the line and transmitted to the other end without any part being used at intermediate points, it is only necessary to place the apparatus for protection at both ends of each wire. For electric traction and overhead lighting circuits, the case is different; for protection has not only to be provided for the plant in the power house, but also for all parts of the line. The experiments of Wurts on the McKeesport and Wilmerding Railway are described. One arrester per mile in sheltered places, up to some twelve or so for more exposed portions of tracks, insure a reasonable degree of safety.—Lond. *Elec. Rev.*, Feb. 23.

Electric Power in Cotton Mills.—A description of the two-phase alternating-current power transmission and lighting plant of the mills at Grosvenor Dale, Conn. The chief interesting point concerning these mills is the use of induction motors belted to jack shafting which is also driven by water motors. When the water power on these wheels is insufficient to drive the mill the induction motors help out, taking power from the generating plant. When the load becomes too great for the generating plant the induction motors reverse their action, becoming induction generators, taking power from the wheels.—*Amer. Elec.*, March.

Water Power Development.—ROBB.—A description of the new additional water power plant of the Hartford Electric Light Company. The new dam is located 11 miles from Hartford—three miles further up the river than the other plant. The fall is 31 feet. All the work, including the dam, power house, machinery and transmission line, was completed within seven months after the letting of the contract. The power house contains two pairs of turbine wheels on horizontal shafts, each pair capable of delivering 1150-hp at 164 r. p. m. These wheels are housed in boiler steel flumes and are direct coupled to two-phase 60-cycle 500-volt alternators. The power is stepped up to 12,000 volts three-phase and transmitted to Hartford over an aluminum transmission line, where it is again stepped down to 2400 volts two-phase and put in parallel with the power from the older station, which is, electrically, 22 miles distant. The total cost of development, inclusive of water rights and transmission line, was $125 per horse-power.—*Amer. Elec.*, March.

REFERENCES.

Refuse Destructors.—LAURIOL.—A paper discussing and recommending the utilization of town refuse for producing electric power. The economy of such a process is discussed for several special cases and the numerical results are given in five tables.—*Bull. de la Soc. Int. des Elec.*, December.

Engines.—A very long illustrated article, filling nearly the whole issue, on different types of automatic high speed engines.—*The Eng.*, Feb. 15.

Variable Speed Power Transmission.—An illustrated description of the Reeves novel and interesting modification of the cone pulleys which have been on the market for some time. It is entirely mechanical in character.—*Eng. News*, March 1

TRACTION.

Direct vs. Polyphase Current for Electric Traction.—HUBER.—A paper read before the Zuerich Eng. and Arch. Society, showing the comparative costs of an electric tramway, 12½ miles long, for direct and for polyphase current, if five cars are in use at once, one at each end and the other three spaced at distances of 3 miles apart, each requiring 20-kw, the cars running at intervals of 30 minutes at a speed of 12 to 15 miles per hour. The trolley system is used with a voltage of 500 to 600 in both cases. With direct current, if the power house is in the middle of the line and the efficiency is 80 per cent., the total cost of the electric part of the work in the plant, with overhead wire to feeders, is given at $23,000, with an annual expenditure of $2660, covering wages, interest and sinking fund; with polyphase current the initial cost is $27,000, the yearly expenditure $3090. If the power house is at the end of the line, and the efficiency 80 per cent., the initial cost for direct current is $50,000, the annual cost $4280; with polyphase current the respective figures are $27,600 and $3125; with transmission by polyphase current and feeding by direct current with an efficiency of 70 per cent., the respective figures are $43,600 and $5495.—*Schweiz. Bazeit.*, 1899, p. 37; abstracted in *Brit. Inst. Civ. Eng. Abstracts*, Vol. 139, Part 1.

Automobiles.—WILLARD.—An article discussing the possibilities of improvements. He thinks that the long looked for lightweight battery will not be brought out unless some new metal or combination is discovered. It is easy to furnish a battery of high capacity and light weight, but it always has a short life. The present standard type of battery is said to give about 7 amperes (ampere hours?) per pound of positive plate. All wiring in an electric automobile should be of generous size; for a carriage weighing 1500 lbs. it should not be less than No. 4 wire. The knife-switch principle is said to be the best to use on the controller. The motor should be adapted to the local conditions where the automobile is to run.—*The Automobile*, January.

French Electric Railway.—JULLIEN.—An illustrated description of the line from St. Gervais to Chamonix, which is the first narrow gauge electric railway in France. The grade is in many places very severe, and in the parts where it amounts to 8 or 9 feet per 100 feet a central rail is introduced for additional brake power. The current is received through brushes, from a lateral rail. There are four power stations between St. Gervais and Chamonix. The total

rise between these stations is 1500 feet, in a distance of about 12½ miles; the minimum radius for curves is 7½ chains.—*La Nature,* July 29; abstracted in *Brit. Inst. Civ. Eng. Abstracts,* Vol. 139, Part 1.

REFERENCES.

Accumulators.—E. H.—The conclusion of the illustrated description of the accumulators which were entered in the recent Paris tests (Digest, March 10). In this part the nine batteries are described which were not discharged more than 60 times. The fault is said to have been a somewhat hasty manufacture. They may give better results in later tests. Short descriptions, partly illustrated, are given. The details are not discussed.—*L'Ind. Elec.,* Feb. 25.

Automobile Patrol Wagon.—A short illustrated description of an automobile patrol wagon of Akron, Ohio, driven by two 4-hp electric motors, the current being supplied by an accumulator battery of 40 cells beneath the seats of the vehicle.—*Sc. Amer.,* March 10.

Electric Cab.—An illustrated article, giving the working drawings of an electric cab for summer use, especially intended to illustrate the design of the side elevation, showing with the position of the different parts.—*The Hub*; *Sc. Amer. Sup.,* March 10.

Electric Traverser for Railway Carriages.—SABOURET.—A reprint, with illustrations, of the article noticed in the Digest March 3.—*El'ty,* March 7.

Snow Plow.—An illustrated description of the snow plow and rail brush equipment, used with success on the Hartford-Middletown and Berlin-Middletown electric railways.—*Sc. Amer.,* March 10.

Eddy Current Brake for Railways.—A reprint, with illustrations, of an English abstract of the German article noticed in the Digest Dec. 30.—*El'ty,* March 7.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

Electric Standardization.—An article referring to the paper of Sellon abstracted in the Digest March 3. Attention is called to the fact that if standardization is to be made possible to any extent, it must begin at the supply station. All the large towns in Great Britain have already adopted some system of electrical supply, and these cannot now be standardized. There are hardly any two supply plants alike; there are all pressures from 100 to 500 volts, and no less than 14 different periodicities between 50 and 120. By introducing high pressure incandescent lamps there would have been an opportunity for standardizing; but it was not taken, and there is now the same variety as before, as there are 200, 215, 220, 250 volts used.—Lond. *Elec. Rev.,* Feb. 16.

An abstract of the discussion which followed Sellon's paper is given in Lond. *Elec. Eng.* and *Elec. Rev.,* Feb. 16; *Lightning,* Feb. 15. The paper of Sellon is reprinted in *El'ty,* Feb. 28.

Kankakee Hospital.—An illustrated description of the electric light and power installation. There are two generators of 150 and 100-kw producing a 220-volt electric current for lighting 3000 incandescent lamps of 16-cp and 220 volts, four 110-volt arc lamps, two in series, for interior illumination, and fifteen 220-volt enclosed arc lamps for lighting the grounds. The current is also supplied to 22 motors, for driving two Linde ice machines, several machines in the washroom, the machine room and the ironing room of the laundry, in the carpenter shop, the patients' workshop, the bakery, etc. There is a private telephone exchange with 47 telephones distributed throughout the institution.—*West. Elec.,* March 3.

Penig.—RUEHLMANN.—An illustrated description of the electric plant of Penig. Water power is used at Thierbach, 1½ miles from the city, to drive a continuous current dynamo of 110 volts and 115 amperes, and a three-phase dynamo with a tension of 2200 volts, 25-amp., and 100 alternations per second. The three-phase current is transformed at Penig into continuous current by means of a synchronous motor coupled to a continuous current generator. The peculiarity is said to be the self-acting double Schuckert switch: "It is so constructed that the slide connections cannot be fused to the contact pieces."—*Zeit. des Ver. deut. Ing.,* 1899, p. 1313; abstracted in *Brit. Inst. Civ. Eng. Abstracts,* Vol. 139, Part 1.

REFERENCES.

Two-phase System.—EHNERT.—A short mathematical article in which he calculates the cross-sections of the outers of a two-phase system with common return when it supplies motors of the ordinary two-phase system, while the lights or light-transformers are connected between the outers.—*Elek. Anz.,* Feb. 11.

Lighting Accessories.—Illustrations with brief descriptions of lamp holders, switch holders, ceiling roses and fuses made at the Stellite Works, England.—Lond. *Elec. Eng.,* Feb. 16.

WIRES, WIRING AND CONDUITS.

Copper Feeders.—A communication on the question of what may be the largest area of copper which can be well insulated and laid as a low tension feeder. It is said to be inadvisable to use a larger cable than about 1½ square inches cross-section. If larger cables are used, the cable drums must be very large and awkward, or if the cable is coiled on smaller drums the insulation would be unnecessarily severely strained. There is practically no advantage in using larger cables, as their cost would be almost the same as if smaller cables were used whose total cross-sectional area equaled that of the single cable. Large cables are very unmanageable feeders to lay, and the cost of laying the separate smaller cables does not exceed that for the single large cable. He gives a table showing the cost of several such feeders laid on the solid system with wood, iron or earthenware troughing, compared with that of bare copper conductors laid on insulators in a conduit. The conduit system is shown to be the cheaper to adopt where it is possible. The hindrance to its universal adoption, however, is the difficulty of finding a continuous space under the foot or roadway. At crossings or places where difficulties arise, it is necessary to change from the conduit system to some other kind, which adds considerably to the cost. According to Crompton a length of feeders estimated to cost $20,000 to $22,500 on the plain, straightforward culvert system, costs probably $27,500, when an average allowance is made for the combined systems, which are usually required. He estimates that the maintenance of the conduit system is less than one-half per cent. per annum on its first cost. In this respect the culvert system is very superior to the cables laid in troughing as probably no cable manufacturer would like to guarantee the maintenance of cables much under 10 per cent. per annum.—Lond. *Elec. Eng.,* Feb. 16.

Safety Interrupter for Overhead Wires.—An illustrated description of an interrupter inserted in a break in a wire, near a pole, and consisting of a tube filled only partly with mercury. When the tube is horizontal, the mercury bridges across the terminals of the wires which go through the ends of the tube. If the line breaks, the tube becomes vertical and the mercury no longer makes connection between the wires, so that the end of the wire which touches the ground or crosses another line, is dead. The cost of the interrupter is very slight.—*L'Energie Elec.,* Jan. 1.

REFERENCE.

Aerial Cables.—DOBBS.—A long well illustrated article giving general rules for the installation of aerial cables.—*Tel. Mag.,* January.

ELECTRO-PHYSICS AND MAGNETISM.

Contact and Chemical Theories.—LODGE.—An abstract of a British Physical Society paper on the controversy concerning "Volta's contact force." The contact theory generally states that the Peltier effect does not measure the local e. m. f. existing at a junction, but measures only the rate at which that e. m. f. varies with temperature. In the thermodynamic equation connecting the Peltier effect with the temperature coefficient of E, the latter, which varies, is not necessarily that at the junction considered, but is the total e. m. f. of the circuit. The reversible heat at a certain junction is a measure of the metallic e. m. f. located there. Those who say it is a temperature variation of the e. m. f. beg the question by locating the whole e. m. f. of the circuit at the particular junction they are considering, usually an interface of zinc and copper. At a chemical junction the e. m. f. is not purely thermal, and hence is not measured by the Peltier effect; it is chiefly of chemical origin and is calculable from the energy of combination of the materials on either side of the boundary. At a metallic junction there is no such chemical potentiality. A strong current may be passed across a zinc-copper junction for years, and no brass is formed. It is therefore improbable that the chemical affinity of zinc for copper is the propelling influence which causes the e. m. f. located at such a junction. The safest and clearest mode of expressing the Volta effect is to say that it consists of an opposite charge acquired by dry zinc and copper, while in metallic contact, a charge which results from an e. m. f. of fixed value, and is controlled solely by this e. m. f. and electrostatic capacity. It is undeniable that the order of the Volta force can be calculated from the differential heats of combination of the metals for oxygen, although it is doubtful whether it can be calculated from the heat of formation of brass. It is a question, which of several contacts is the effective one, whether the contact and chemical affinity across the metal junctions is the effective cause or that across the metal air junctions. The metal-air force is of the order of volts, the metal force of the order millivolts. When a piece of zinc is put in contact with a piece of cop-

per, the surrounding oxygen atoms (ions) move slightly away from the copper to the zinc, this slight motion produces the whole Volta effect. All that is necessary for its production is the inherent film on the surface; all the rest of the gas is merely dielectric and might be substituted by a vacuum.—Lond. *Elec. Rev., Elec. Eng.,* Feb. 16.

Irreversible Radiation Processes.—Planck.—A theoretical article giving a summary of his five German Academy papers on this subject (Digest, Dec. 9). He applies the laws of thermodynamics to the electromagnetic theory of light; as the phenomena of heat satisfy the second law of thermodynamics, the electromagnetic theory must also embrace this law in its generality. He finds the necessity of enunciating electrodynamic laws analogous to the thermodynamic, for instance, laws of electric entropy similar to that of heat entropy. The Stefan-Boltzmann law, that the total energy radiating from a black body is proportional to the fourth power of the absolute temperature, and Wien's law concerning the distribution of energy in the spectrum of a black body are found to be strict results of the two fundamental laws of thermodynamics.—*Ann. der Physik,* January; abstracted in *Ann. Jour. of Sc.,* March, and *Science,* March 2.

New Electric Condenser.—Bradley.—He has discovered a new substance which has a specific inductive capacity fifteen times greater than that of paraffined paper and about nine times greater than that of mica. The material is stearate of lead.—*Zeit. fuer Instrumentenkunde,* December; noticed in *Am. Jour. of Sc.,* March.

REFERENCE.

Radio-Active Matter.—An illustrated description of Becquerel's investigations of the behavior of radio-active matter in a magnetic field.—*Sc. Amer.,* March 10.

Electro-Chemistry and Batteries.

Electric Furnaces for Producing Calcium Carbide.—Carlson.—The first part of a long article discussing the relative advantages and disadvantages of furnaces in which the heat is produced by the Joulean effect of resistances or by an electric arc; also those for continuous or interrupted operation. In resistance furnaces no free electrodes are necessary; the heat is produced by the resistance of the liquid bath, the current is supplied to the bath through carbon plates in the walls, which are attacked only slightly, so that the consumption of the carbon electrodes is small and the furnace can be operated continuously for a long time, while in arc furnaces the electrodes must be replaced after two to six days so that the operation must then be discontinued. The disadvantages of resistance furnaces are the following: The current cannot be well regulated, as it depends upon the resistance of the melted bath which varies greatly with variations of the cross-section and with the temperature, which is not at all constant. The melted carbide is heavier than the mixture of calcium and carbon, so that the latter floats upon the surface; the greatest production of heat should therefore occur on the surface, which is the case in arc furnaces, but not in resistance furnaces. For resistance furnaces alternating current must be used, to prevent electrolysis. For the ordinary metallurgical and other melting processes it is desirable to operate the furnace continuously; interrupted runs are, however, better for the treatment of materials with a high melting point. From furnaces for continuous operation the carbide is in liquid form and comes into contact with the walls, which must therefore be made of very refractory material. This is not necessary in furnaces with interrupted operation, as the melted carbide cools the furnace itself and is taken out in solid form. He shows furthermore that the output of carbide per kw-day is greater for arc furnaces worked intermittently than for resistance furnaces run continuously. Calcium carbide has no well defined melting point; there is a great difference between the temperature at which the carbide becomes viscous, which is sufficient for furnaces with interrupted operation, and that where it becomes quite liquid, which is necessary for continuous operation. In the first case 2800° to 3000° are sufficient, in the second 3500° to 4000° C. are necessary. At the latter temperature quite a strong dissociation of the carbide occurs, which diminishes the output. To produce a certain quantity of calcium carbide by a continuous process more heat is therefore necessary than with intermittent operation; this excess of heat is consumed in heating the carbide from 3000° to 4000° C., in producing that part of carbide which is destroyed afterwards by dissociation, and in distilling away the metallic calcium produced by the dissociation. Further, as calcium carbide heated to 4000° C. flows only with difficulty, it is necessary to diminish the melting point by adding an excess of calcium to the carbide; it is then possible to work at a temperature of about 3500°, but the product thus obtained contains a lower percentage of carbide. With continuous operation the liquid carbide is taken from the furnace at 3500° to 4000° and takes from it a great quantity of heat, while with interrupted operation the carbide cools in the furnace and the heat given out from the fluid produces new carbide, without supply of electrical energy to the furnace; this reaction occurs till the temperature has decreased to 1200° to 1500°. Kiesewetter claims that he can produce carbide in a furnace at 1500°. Borchers proposes to produce it in a furnace heated by the combustion of carbon with liquid air; this, however, has not yet been done in practice. During the melting process considerable quantities of metallic calcium are always produced. If the carbide is cooled down quickly, as with furnaces with continuous operation, that calcium remains; under the action of water, hydrogen is produced in the acetylene; if, however, the carbide is cooled slowly, as with furnaces operated intermittently, the calcium combines with the free carbon which is assumed to be present; this reaction occurs down to 800° C. He then considers the loss of heat by radiation and conduction and finds for a special furnace, the numerical data of which are given, that these losses are 6.3 per cent. of the whole energy supplied to the furnace with interrupted operation, while for the same furnace with continuous operation they would be 22.1 per cent. In the latter case they can be diminished by making the walls thicker.—*Zeit. fuer Elektrochemie,* Feb. 8.

Copper Deposition.—Cowper-Coles.—An illustrated description of a method for the electrodeposition of copper from alkaline solutions, used in a plant in Belgium. The zinc plates to be coppered are first dipped in a tank containing a hot solution of sodium carbonate, about 1 lb. to the gallon of water, in order to remove the grease. They are then well rinsed in a washing tank and placed as cathodes in the copper depositing vat, having been secured to dogs fitted to cross bars, which rest on copper strips attached to girders carrying the anodes, which are of rolled copper and are bolted to copper strips running the whole length of the compound anode and cathode bars. The electrolyte is the double salt of cyanide of copper and potassium, and is worked at a temperature of 150° F., the current density being 10-amp. per square foot of cathode surface, and the voltage at the terminals of the electrodes 1.6. The solution is circulated through regenerating tanks by means of a centrifugal pump, over a filter bed composed of copper in a fine state of division. After the deposition the plates are washed in water and polished by passing them between revolving brushes. A diagram shows the actual as compared to the theoretical weight of copper deposited.—Lond. *Elec. Rev.,* Feb. 16.

Storage Batteries.—An abstract of an interesting report of Mr. Hammond's as consulting engineer, on the five tenders received by a British municipality for the supply of accumulators to their new electrical plant. They were specified to be capable of maintaining 10,000 lamps of 8-cp burning for four hours, which is equivalent to an output of 600-amp. for that time. Owing to the voltage of the supply some 300 to 312 cells were required to meet the conditions of the specifications. The lowest tender, that of the Tudor Company, for the accumulators, stands, lifting tackle and contingencies, is $40,775, while the highest is $62,835. The details of the five tenders are analyzed in the report. The accumulators have to supply the 10,000 lamps for four hours without the voltage in any of the cells dropping below 1.8 volts. The lowest tenderer estimates fulfilling this condition with 310 cells, each having 23 large plates. Another firm uses as many as 61 plates. The use of a few large plates is a distinct advantage, as it enables a battery of accumulators of a given capacity to be erected in a smaller space than if more plates per cell are used. In the present case it was specified that the width of the battery room should be 30 feet. The lowest tenderer requires this room to be 130 feet long to contain the cells in one tier on the floor level, while another maker requires as much as 228 feet. The Tudor Company guaranteed a 77 per cent. efficiency with 600-amp. discharge and 78½ per cent. efficiency with 300-amp. discharge; it proposes undertaking the maintenance contract for 14 years for an annual sum of $2,025, which is hardly 5 per cent. on the capital outlay, while another firm offered to maintain at 4½ per cent., but as their tender was higher, the annual sum for maintenance came out larger. The maintenance rates with other makers went as high as 8½ per cent. There is a considerable divergence in the alteration of the ampere-hour capacity with variations of the period of discharge. The Tudor Company provides for a discharge rate of 1450-amp. for one hour and for 280-amp. for 10 hours. Another firm, for the same discharge for four hours, guaranteed 1400-amp. for one hour and 360-amp. for 10 hours. It is pointed out that as refuse destructors are to be used in this

case, high discharge rate is of the utmost importance.—Lond. *Elec. Eng.*, Feb. 16.

Electrochemical Equivalents of Copper and Silver.—RICHARDS, COLLINS and HEIMROD.—A paper read before the National Academy of Sciences, giving an account of a careful experimental investigation in which they endeavored to clear up the discrepancies in former researches and to develop a method in which the sources of inaccuracy were avoided. They found a deposit of 1.1172 milligrams of silver per ampere second and 0.3292 milligrams of copper, which agrees better with Faraday's law than former numbers.—*Proc. Amer. Acad.*, Vol. 35; abstracted in *Am. Jour. of Sc.*, March.

Electrolysis.—KNUDSON.—An account of the effect of joint resistance upon the electrolysis of underground piping due to street railway currents, pointing out the fact that the independent return method is of little value with jointed pipes, although it may work successfully with continuous conductors, such as cable sheathing.—*Amer. Elec.*, March.

REFERENCES.

Aluminum.—OBALSKI.—A short article giving a brief outline of the electrothermal and electrochemical methods of producing aluminum.—*La Nature*, Jan. 27.

Rotating Ozonizer.—An illustrated translation of the French article noticed in the Digest Nov. 4.—*Sc. Amer. Sup.*, March 10.

Volta Cell.—PELLISSIER.—An article describing some previous experiments of other investigators which may have inspired Volta in making his invention.—*La Nature*, Jan. 20.

Accumulators for Traction,—ZACHARIAS.—A reprint of the English abstract noticed in the Digest March 10.—*El'ty*, March 7.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Electrical Thermostat.—DUANE and LORY.—An illustrated description of an easily adjustable thermostat that keeps the temperature of a bath constant to within 1-2000th of a degree centigrade for a considerable length of time. Through a conducting liquid, or through wires immersed in one which is non-conducting, flows an electric current that is sufficiently large to heat the liquid up to a temperature considerably above the constant temperature required. A system of tubes containing a liquid with a large temperature coefficient of expansion is placed in the bath. By means of a suitable mechanism the expansion of this liquid interrupts or reduces the strength of the heating current when the required temperature has been reached. The temperature of the bath then begins to fall, whereupon the original current is started again automatically. The efficiency of the apparatus is due to the fact that the makes and breaks follow each other so rapidly, that there is not time for the temperature to change perceptibly between them. Often two, three or even more interruptions occur in one second.—*Am. Jour. of Sc.*, March.

Electrostatic Measuring Instruments.—A short article referring to Addenbrooke's communication on his instrument (Digest, Feb. 17). The sensitiveness does not appear to be greater than that of the Ayrton-Mather instruments. Addenbrooke's application of his electrometer to measuring the alternating voltage of a telephone circuit is said to be curious, since the instrument appears to be unsuited for the purpose, which is explained. The idiostatic electrometer is said, however, to be rapidly establishing itself as the only satisfactory instrument for alternating voltages, and if the mechanical difficulties due to the small value of the forces can be surmounted, soft iron and hot wire instruments should disappear.—Lond. *Elec. Rev.*, Feb. 23.

Combined Gravity Ammeter and Voltmeter.—A short illustrated description of an instrument devised by Morris. It is of the gravity type, there being no permanent or electromagnets used in its construction. It is therefore claimed that it never requires recalibrating. It is, however, not free from errors due to external magnetism. There is a double scale, the top of which is used for volts and the bottom for amperes. There are two contact keys, one for measuring the e. m. f., the other for the current. The instrument is intended chiefly for primary battery testing, as with ordinary work a key in the main circuit would not be feasible.—Lond. *Elec. Eng.*, Feb. 16.

REFERENCES.

Devices for Producing Large Phase Differences.—GOERNER.—An illustrated abstract of the article noticed in the Digest Nov. 25; it is chiefly a description of the Hartmann and Braun's alternating current wattmeter.—Lond. *Elec. Rev.*, Feb. 16.

Electric Meters.—UPPENBORN.—A long paper, read before the Electrotechnical Society of Munich, on the new German law for the sale of electrical energy.—*Elek. Zeit.*, Feb. 15.

Switchboard Instruments.—BAXTER.—The first part of a well illustrated description of the different principles of construction of ammeters and voltmeters for switchboards.—*Amer. Mach.*, March 8.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Tramway Return Currents and Submarine Telegraphy.—JAMIESON.—The first part of an illustrated paper read before the Inst. of Eng. and Shipbuilders of Scotland, in which he gives an account of the disturbances in the working of the submarine cables landed at Cape Town by the neighboring electric tramways. He describes how submarine cable signal currents are transmitted, received and returned to the sending station, and gives the relative positions of the submarine cables and electric tramway lines at Cape Town. The Cape Town shore end of the main submarine cable to Mossamedes passes round the southeastern curve of Table Bay in order to avoid the anchorage. A part of the electric tramway lines, which are worked on the overhead trolley system with the return circuit through the rails, lies almost parallel to the submarine cable.—Lond. *Elec. Rev.*, Feb. 23.

REFERENCES.

Wireless Telegraphy.—MARCONI.—Reprints of the English abstract of his Royal Institution lecture, noticed in the Digest March 10.—With illustrations, *West. Elec.*, March 3; without illustrations, *Elec. Rev.*, Feb. 28.

Self-Induction of Cables.—BREISIG.—An English abstract of the German article noticed in the Digest Dec. 30.—Lond. *Elec. Rev.*, Feb. 16.

MISCELLANEOUS.

Ships' Compass.—An illustrated description of the Evoy compass devised to avoid the serious errors in compasses placed on iron ships. The principle, pointed out by Scoreby in 1854, is used, that a standard compass paced aloft would be free from magnetic disturbances which are serious on the level deck. The object of the Evoy compass is to make the reading of a masthead compass possible on the bridge or on any point on the deck which may be selected. For this purpose the compass is suspended from the jumper stay between the two masts, being carried on two vertical stays accurately secured to the deck on the fore and aft line. The process of taking a reading is as follows. The compass is hauled up to just below the stay, where it is free from most of the magnetic influences of the ship. The compass is then released automatically, so that the card soon takes up its correct position in the magnetic meridian. The card is then secured in position by means of the spherical cups at each side, and the compass is then brought down to the deck, enabling an accurate comparison to be made between its readings and that of the compass on the bridge.—Lond. *Elec. Eng.*, Feb. 16.

Heating Railway Cars.—A note describing the Tommasi system. The description is not clear, but it seems that he uses a coil of resistance wire embedded in a material having great latent heat of fusion, such as crystallized acetate of sodium, hyposulphide of sodium, etc. The current is generated by a dynamo driven from the axle of the baggage car. The principle seems to be that this material acts as a large reservoir of heat. It seems that at the start the heaters are heated by immersion in boiling water, so that the only heat supplied by the current is that which is radiated as distinguished from that necessary to bring the material to the desired temperature. It is said that the heaters will remain active for at least four hours, presumably with no current passing through them.—Lond. *Elec. Rev.*, Feb. 16.

Fatal Accident With Low Voltage Current.—KOLBEN.—An article on an accident in which a workingman in a potash and alcohol plant was killed by contact with an uninsulated part of a low voltage alternating current circuit for four or five minutes. The voltage between that part and the earth was only about 95 or 96. The conditions were very favorable for a severe shock, as the man was standing upon an iron tank covered with soda lye of very good conductivity, his boots being wrapped with rags of twilled linen; he was, moreover, a drunkard. The conclusion is drawn that in electrochemical plants even low voltage circuits should be very well insulated.—*Elek. Zeit.*, Feb. 15.

The Functions of an Engineer.—PREECE.—An address of general nature, delivered to the Glasgow Association of Students of the Brit. Inst. of Civil Engineers. In the first part he treats with the practice of engineers and gives an outline of the functions of the different branches of civil, military and naval engineering. In the second part he discusses the making of the engineer. The mod-

ern engineer is the outcome of high-class and long-sustained education. It is not a question between science and practice; it is a question between science and rule of thumb.—Lond. *Elec. Eng.*, Feb. 16; *Ind. and Iron*, Feb. 16.

REFERENCES.

Gutta Percha.—FEYERABEND.—A long summary, with several tables, describing the production of gutta percha, the different kinds, their constitution and physical, mechanical and electrical properties, and their application.—*Elek. Zeit.*, Feb. 15.

Röntgen Rays as Depilatory.—An article on successful experiments, made by Dr. Wood, to remove hairs from a woman's face by Röntgen rays.—*Sc. Amer.*, March 10.

Municipal Franchises.—FOOTE.—An abstract of a lecture, delivered at the Ohio State University on the economic aspects of municipal franchises.—*Elec. Rev.*, Feb. 28.

New Books.

THE UNIVERSAL ELECTRICAL DIRECTORY (J. Berlys). 1900. London: H. Alabaster Gatehouse & Co. 1272 pages. Price, 7s. 6d.

The nineteenth annual volume of the "Red Book" contains about 30 more pages than the volume for the preceding year, the total being now 1272. The American section comprises 182 pages, divided into an alphabetical and a classified section. Included in the former are about 5000 names of manufacturing companies, electrical engineers, etc., followed by a classification by trades. As the work covers in similarly complete manner the entire world, its value as a book of reference is obvious.

CONDENSERS. A Series of Lectures and Articles upon the Subject reprinted from the columns of *Power*. New York: The Power Publishing Company. 79 pages, 33 illustrations. Price, 50 cents.

From the simplest elementary "Kindergarten" matter, the reader is taken by easy stages to the more profound depths of condenser engineering, and is treated to examples of both theory and practice. Beginning with the measuring of pressure of the atmosphere, and the nature and measurement of a vacuum, the production of vacuum by condensation is described and the gain by condensation shown. The different types of condensers are then described and plainly illustrated. The advantages of the various types are pointed out and instructions given how to attach, and how to stop and start the various condensers in use by steam consumers.

A chapter devoted to condenser capacities is added, the subject matter of which is quite complete and comprehensive. There are added instructions for calculating the capacity of the pumps necessary for condenser working, and a chapter of formulas for calculating the size of condenser mains. Tables are added giving the capacity and data of well known makes of steam pumps, the pamphlet closing with a comprehensive index.

POWER TRANSMISSION BY ELECTRICITY AND APPLIED BY THE ELECTRIC MOTOR, INCLUDING ELECTRIC RAILWAY CONSTRUCTION. By Philip Atkinson, Ph.D. New York: D. Van Nostrand Company. Price, $2.00.

The first edition of the book appeared in 1893 under the title "The Electric Transformation of Power," a title which the author considered to be "too suggestive of techincal intricacy" to be continued; and the book now appears in a second edition under a new title and contains some additional matter. The book is devoid of mathematical phraseology and presumably may be perused by the general reader without any especial scientific knowledge.

The author first attempts the definition of the technical terms likely to occur in such a book, and has been partially successful, though he has fallen into the common error of mistaking abbreviation for elementary presentation. In the present work four and a half pages are taken up with the discussion of conservation of energy, potential, the fundamental electrical and physical units, and electrical horse-power. Either the reader should have been assumed to be familiar with these terms and their discussion entirely omitted, or they should have been adequately discussed in simple language; and at least ten times this space should have been given to them. As an instance of the confusion which follows abbreviation the watt is defined by the statement, "The energy by which electric work is performed includes both electromotive force and electric current, and must therefore be expressed by their product, which is represented by the unit known as the watt." The energy quantity does certainly include both the electromotive force and the electrical current quantities, but there is no expressed nor implied necessity that the energy quantity is a function of the product of these two quantities. The entire chapter abounds with discrepancies of this character and one can scarcely understand how a reader ignorant of such terms can receive any illumination from its wording.

The following chapter deals with the principles of the electric motor, and in it the author is more successful, and presents his subject matter in a conventional but somewhat instructive manner. Some eight pages are devoted to the subject of motor design, and this is attempted without a single illustration or mathematical formula. The entire subject of design should have been omitted as it does not appear to be called for in a work of this character.

Under the heading of stationary motors the attempt is made to describe single and polyphase motors, which properly belong to the book; but the text is entirely descriptive of the external anatomy of these motors and does not convey even a faint conception of the peculiar properties of the alternating current motor. One looks in vain for a prefatory statement of the principles of the alternating current, which the present state of the art necessitates in any general account of this type of motor. The chapters on the application of the stationary motor and electric railways are recitals of the various applications of electrical power. As an instance of the treatment, the railway controller is shown with the cover opened and the text attempts a discussion of the series-parallel connections, without any diagrams whatever. Another singular matter in the chapter on railways is that the description of the entirely electrically operated elevated railway system of Chicago is covered in some eighteen lines, while perhaps two pages and an illustration are devoted to the Liverpool Elevated Electric Railway. The concluding chapter on central stations is practically a recital of the growth and development of the several stations of the Chicago Edison Company.

The book concludes with a short paragraph on direct connected dynamos; and the concluding sentence of the paragraph and the book is—"Several of the new Edison central stations have been equipped in this manner, as already described; two dynamos being directly connected with each engine, one on each side." This sentence carries its own review of the book with it.

The sources from which the book appears to have been mainly written are, manufacturers' circulars and the descriptive advertising articles in the electrical journals; at the same time it would be unfair to the author not to admit that there is evidence that some articles of a scientific character in these journals have been consulted.

The most effectual criticism of such books, written for commercial rather than scientific ends, would be the writing of really good works for general readers. If those possessing the requisite literary style and technical ability would seriously set about the task it would probably be productive of more good than is at first apparent. Models for this work are not wanting: Professor Trowbridge, of Harvard, may be taken as an admirable guide in his magazine articles, especially on electrical subjects, and in his book, "What is Electricity?" and Mach's lectures on popular science could also be studied to advantage.

BOOKS RECEIVED.

MESURE DES GRANDEURS ELECTRIQUES Dans les Circuits a courants alternatifs. By Omar de Bast. Liege: Imprimerie de Leon de Thier. 61 pages, 21 illustrations. Price, 2.50 francs.

Directory of Electrical Societies, Etc.

NORTHWESTERN ELECTRICAL ASSOCIATION. Next meeting, Waupaca, Wis., June 26, 27 and 28, 1900.

CHICAGO ELECTRICAL ASSOCIATION. Next meeting, March 16. Paper: "Arc Lighting," by F. N. Boyer.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, New York. Next meeting, March 28.

CANADIAN ELECTRICAL ASSOCIATION. Next meeting, Ottawa, Ont., June 27, 28 and 29.

AMERICAN STREET RAILWAY ASSOCIATION. Next meeting, Kansas City, Mo., Oct. 16, 17, 18 and 19, 1900.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Next meeting, Chicago, May 22, 23 and 24, 1900.

NATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Next meeting, Pittsburg, Pa., Sept. 25, 26 and 27, 1900.

AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION. Next meeting, New York, Sept. 25, 26 and 27, 1900.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Next meeting, Detroit, Mich., June 20, 1900.

Charging Station and Automobiles of the American Electric Vehicle Company.

One of the most important problems now before the manufacturers of automobiles for prompt solution is the securing of opportunities to exhibit their vehicles and, next, to afford to purchasers the requisite facilities for charging and housing. To settle all the questions and difficulties that thus arise, in each large city, is by no means an easy task, but it cannot be "dodged," and the manner of dealing with it is likely to bring about many interesting developments. We are able to present herewith two engravings illustrating the charging station recently established by the American Electric Vehicle Company at 134 West Thirty-eighth Street, New York City. Upon its establishment of headquarters in this city, with factory in Hoboken, N. J., the company found it imperative to give intending purchasers a chance for inspection of the various types of automobile built by it, and after the automobile had been sold, the next point to be raised was that of facilities for charging. Mr. C. E. Corrigan, general manager of the company, made a very happy selection in the present station. A more central spot in New York could not be selected, and yet the region just west of Broadway has barely begun to be rescued from the horse stables that have spoiled it for human occupation. The Metropolitan Opera House and all the leading theatres are within stone's throw, and all the fashionable life of upper Broadway surges

FIG. 1.—EXTERIOR VIEW OF CHARGING STATION.

along within half a block of the station which, prior to its conversion, was a distasteful example of the old style livery stable. Now it is sweet and clean and pretty throughout. Upstairs are the offices of the company, and handsome waiting and retiring rooms for patrons, with files of all the literature of automobilism. Above the building is a tall sign which gleams nightly with hundreds of incandescent lamps advertising the new art in general and the American Electric Vehicle Company in particular.

The lower floor of the station is devoted to charging, current being taken in at a board and meters in the front. The rear portion of the floor, which runs well through the block, is devoted to cleaning up vehicles on their return. All around the walls are charging plugs, and as many as thirty vehicles will be taken care of at one time. The decorations of this department are also quite handsome, and the contrast between the "horseless age" and that which preceded it is most vividly presented in the luxury and finish of everything, the

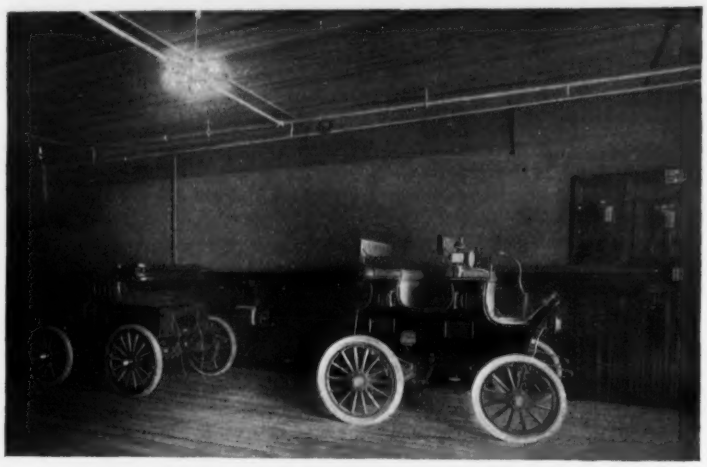


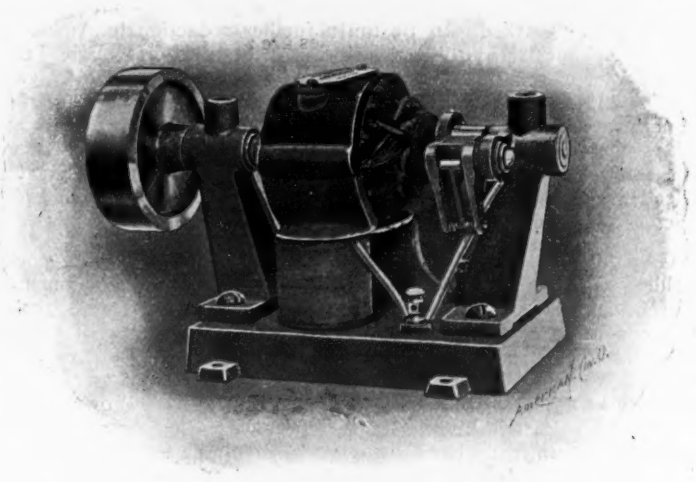
FIG. 2.—INTERIOR OF CHARGING STATION.

floor being fit for a ballroom. Current is on night and day from the Edison street mains, and there is a night bell by which patrons can summon the attendants who are always present.

The American Electric Vehicle Company is beginning to mass at this new station, for exhibitional purposes, a number of types of its new automobiles, two of which, a buggy and a surrey, are shown. The general construction, with one motor on the rear axle, is retained, with the regular equipment of 44 cells, but the lines of the carriages are being very much beautified, and a number of features of economy worked out.

Electric Igniter.

One of the latest types of gas engine igniters is shown in the accompanying illustration. The igniter is a dynamo of the direct current type. The field magnets are made of the highest grade of magnetic steel, which has a permeability equal to the softest wrought iron. The armature is insulated with the best materials and the commutator is large, well made and insulated with mica.



GAS ENGINE IGNITER.

Carbon brushes are used and require but little if any attention during an entire season's run.

These igniters may be run at so slow a speed as 800 revolutions per minute and will work satisfactorily at any speed above this. They may be run 2500 revolutions with safety.

The dynamos are painted with waterproof paint and water may be thrown on them while running without doing any damage whatever. They are made by the Carlisle & Finch Co., Cincinnati, O.

NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET.—The result of last week's operations in Wall street was a decline in twelve industrials from 62.76 to 61.11, and a decline in the average of twenty railway stocks from 78.05 to 77.90. Sales have been in gradually decreasing volume, the feature of the market being the liquidation in specialties of the industrial group. As to the outlook there seems to be an accumulation of indications that there may be a slight check in business. Trading in the market for outside securities during the past week was fairly active, except on the last two days, but the activity was accompanied by a good deal of irregularity. Stocks subject to assessment have of late suffered rather heavy declines, and the demand for these issues has not been sufficient to keep off heavy recession from the paid-in value of these stocks. On Saturday Illinois Transportation, upon which $5 has been paid, sold at 1½, and current quotations for other stocks of this group are much below the paid-in value of the several stocks. By the terms of the recent consolidation of the Electric Axle Company with the Columbian and other companies this stock was made full paid, and during the week a similar plan has been presented to the stockholders of the New England Electric Vehicle Transportation Company. The tendency now is to do away with large nominal capitalization and to bring stocks down to a more solid basis, and one nearer the actual paid-in value of the same. The sales of Brooklyn Rapid Transit for the week were 77,705 shares, the closing quotation being 67¼, a net loss of ⅜ for the week. General Electric closed at the same figure as the week previous—125, the total transactions for the week being 2110 shares. Manhattan Elevated showed a net loss of ⅝, closing at 93¾, and Metropolitan Street Railway closed the week with a net loss of 4 points on sales of 30,616, the closing quotation being 164½. This stock went as high as 171½ during the week, the lowest figure being 162. Third Avenue was a little more active and closed with a net gain of 1⅛ on the week's transactions of 154,520 shares. The range of prices for this stock was 60@53½, closing at 56½. Western Union showed a little more firmness and closed with a net gain of ¾. The sales of this stock amounted to 5460 shares, and the highest, lowest and closing quotations were 83¾, 81⅞ and 82¾ respectively. Among the outside securities at New York the following closing quotations are recorded: Electric Vehicle, com., 36; do pfd., 90; Electric Boat, com., 16; do pfd., 30@35; General Carriage, 7⅜@7½; Illinois Electric Vehicle & Transp., 2; N. Y. Elec. Vehicle Transp., 7@7¼; New England Elec. Transp., 5@5½; St. Louis Railways, com., 25; do. pfd., 80; Telephone, Telegraph & Cable Company of America, 4@4⅜; New York & New Jersey Telephone closed at 163 bid, 175 asked. In Boston a further reduction in American Bell Telephone is recorded, the closing price being 311; Erie Telephone was also weaker, closing at 104½; Mexican, 3; Michigan, 100, and New England, 135. In the Philadelphia stock market American railways closed the week at 3⅛@3¼; Electric Storage Battery, com., 78@79; do. pfd., 96@97; Electric Company of America, 11⅛@11⅜; General Electric Automobile, 2@2¼; Pennsylvania Electric Vehicle, com., 5@5¼; do. pfd., 2@2⅛; Philadelphia Electric, 5@5¼, and Philadelphia Traction, 96⅝@96⅞.

GAS AND ELECTRIC DEAL.—At the meeting last week, stockholders of the New York Consolidated Gas Company, with but one dissenting voice, voted to increase their capital stock from $39,078,000, consisting of 390,078 shares, to $54,595,200, consisting of 545,952 shares. The purpose of the stock issue is to retire $36,000,000 of Consolidated Gas Company debenture bonds, which were issued temporarily last January to acquire $36,000,000 of the stock of the New York Gas & Electric Light, Heat & Power Company. The details of the deal have already been given in these columns. The purchase price was not, and never has been, stated, but President Gawtry advised the issue of $15,517,200 additional Consolidated Gas stock to redeem the $36,000,000 worth of debentures issued to acquire the transaction. On the basis of exchange Consolidated Gas shares figured out a value of $232, but this is purely arbitrary. It is believed by some that the transaction was consummated on the basis of 40 shares of Consolidated Gas at the valuation of 175 for 100 shares of New York Gas & Electric Light, Heat & Power Company stock. This figures out the stock of the latter on its capitalization of $36,000,000 at about $75 a share. William C. Whitney, who went into the directorate of the Consolidated Company as one result of the deal, spoke freely of the matter after the meeting. The transaction, he said, was mutually advantageous.

NEW ENGLAND ELECTRIC VEHICLE.—Circulars have been sent to the stockholders of the New England Electric Vehicle & Transportation Company touching the financial plans of that concern. The company has on hand, the circulars state, a sufficient portion of its capital subscribed to meet all the requirements of its business for some time to come, and it is thought that a large proportion of the stockholders of the company would prefer to have their present holdings of shares fully paid rather than have them assessable by vote of the board of directors. If, in the future, the development of the business requires additional capital, it is always in the power of the corporation to increase its capital stock, giving the stockholders the right to subscribe for the same, but without imposing any obligation on them to do so. The directors, after a full consideration of the matter, and consultation with some of the leading shareholders, have voted in favor of reducing the present capital. The directors have voted that it is advisable to decrease the authorized capital stock of the said company from $25,000,000, divided into 250,000 shares of the par value of $100 each, to $5,000,000, divided into 500,000 shares of the par value of $10 each, the decrease to be effected by reducing the par value and increasing the number of shares as aforesaid, and by purchasing at par the original twelve shares of fully paid stock of the company of the par value of $100 each by issuing from the unissued stock in lieu thereof and in payment therefor 120 shares fully paid of the par value of $10 each. Stockholders will vote upon the question on April 3.

JERSEY LIGHTING AND TROLLEY.—The National Power & Manufacturing Company was organized in Jersey City last week, with headquarters in the Registrar and Franklin Company building. It has a capital of $2,000,000. The organizers are Armitage Mathews, of the Board of Aldermen; Henry M. Haviland, of New York, and James C. Young, of Jersey City. The organization of this company is exciting great interest among electrical people in Hudson and Essex counties, where the Shanley syndicate and the United Gas Improvement Company furnish nearly all the electricity and gas that are used. It is known that the organizers of the new company are not allied with the Shanley-E. F. C. Young electric syndicate. It is also a fact that Mr. Mathews and James C. Young, two of the organizers of the new company, helped to start the New Jersey & Hudson River Railway & Ferry Company, which was formed last week with $1,750,000 capital, and which absorbed the Bergen County Traction Company, the Fort Lee Ferry Company, and the Ridgefield and Teaneck Railway Company. It was stated that the National Power & Manufacturing Company will not be run as a part of the new trolley company, but will be controlled largely by Western capitalists. It may operate largely outside of New Jersey. In case this is incorrect and the new company should decide to become a rival to the powerful Shanley lighting interests, there may be interesting developments.

THE PAN-AMERICAN EXPOSITION.—The Directorate of the Pan-American Exposition has been considering the question of raising money to forward the enterprise. The best means of getting funds received careful attention; it was finally decided to dispose of the $1,300,000 of stock remaining unsold of the $2,500,000 for which the company was capitalized. A committee of fifteen, to be known as the Ways and Means Committee, will have this matter in charge. W. H. Hotchkiss will be chairman. The transportation, railroad and express companies will be asked to take large blocks of this stock and the city may be asked to lend its aid.

THIRD AVENUE'S AFFAIRS.—Messrs. Wm. L. Bull, James N. Jarvie, Emanuel Lehman and Frederick Uhlmann have been requested by holders of a large amount of Third Avenue Railroad Company stock to act as an advisory committee for the protection of the interests of shareholders. It is reported that Henry Hart and interests allied with him in the Third Avenue Railroad Company are working to have some other person than Hugh J. Grant appointed permanent receiver of the road.

THE CENTRAL DISTRICT & PRINTING TELEGRAPH COMPANY, Pittsburg, Pa., has adopted a resolution directing the officers to offer to the stockholders $1,000,000 of the recently increased capital. The stock was increased some time ago from $4,000,000 to $7,500,000, the addition to be used for extraordinary improvements. The company has let the contract for a branch exchange building to be erected on South Sixteenth Street, at a cost of $14,000.

THE LONG ISLAND LIGHTING DEAL.—It appears that the report that the Queens Borough Electric Light and Power Company had passed into the control of the New York Gas & Electric Light,

Heat & Power Company, was not correct. It has developed since that the company has passed into the control of the Kings County Electric Light & Power Company, of which Mr. Anthony N. Brady is president.

MONTREAL STREET RAILWAY.—The directors of the Montreal Street Railway Company will ask for power to increase the capital stock of the company $1,000,000, making it $6,000,000. The increased capital, it is stated, will be utilized in the purchase of new rolling stock and providing additional power.

ADDITIONAL ERIE STOCK TO BE LISTED.—Application has been made to the New York Stock Exchange to list $5,000,000 additional stock of the Erie Telegraph & Telephone Company.

CINCINNATI RAILWAY DIVIDEND.—The Cincinnati Street Railway Company has declared a quarterly dividend of 1¼ per cent., payable April 2.

LOUISVILLE RAILWAY MORTGAGE.—It is stated that the issue of $150,000 Louisville Railway second mortgage forty-year 4½ per cent. bonds was over-subscribed eighteen times. It is understood the price paid by the successful bidders was 105½@105¾.

Commercial Intelligence.

THE WEEK IN TRADE.—General trade distribution during the past week showed a tendency to expand, as a result of the relief from the hampering effects of the recent stormy weather. The general business conditions possessed some interesting facts. Special causes are not needed to account for some pause after a year of unprecedented buying, says *Dun's Review*. That such trade could not continue without a pause was evident, and there is now not the excessive speculation which threatened monetary trouble a year ago. There was a certain hesitation in business, with shrinkage in its volume which, however, is not unusual or unnatural at this season of the year. The obstacles to business were considerable, some of them being brought about by strikes in the building trades or of machinists and others at Chicago, where, it is said, many industries are affected and the wages of 50,000 employees are involved. On the other hand, specially encouraging features are found in the iron and steel industry, where 35,000 employees have had their wages further advanced. Wages are now nearly 50 per cent. higher than a year ago. The failures last week were in amount $3,482,827, manufacturing $1,118,651 and trading $2,161,211. Failures for the week were 205 in the United States against 182 last year, and 33 in Canada, against 37 last year. Copper trade conditions seem to warrant the anticipation of larger demand for copper stocks and the developments in this quarter of the market are watched with much interest. The quotations are, for Lake, 16¼@16⅜; Electrolytic copper in cakes, wire bars or ingots, 16@16¼; in cathodes, 15⅞@16⅛.

THE PRICE OF COPPER.—It is thought in metal circles that the present active demand for copper is likely to continue and that prices will not weaken. Speaking of the copper situation last week Jesse Lewisohn, of Lewisohn Bros., said: "The consumption of copper in this country, as well as abroad, is phenomenal. As this is the electrical age, copper is being put to new uses every day and the demand is naturally large. The product of the various mines throughout the country has been sold months ahead, but the demand appears to be as pronounced as ever. England is now in the market for a large amount of American copper, thousands of tons of it being required for war purposes. Germany and France are also buying liberally. The demand from the latter country can be traced to the construction of telephone systems in the various provinces. Germany needs it for traction and manufacturing purposes. It is estimated that one-third of the entire copper production of the country is now being exported."

CINCINNATI EDISON APPARATUS.—At the recent annual meeting of the Cincinnati Edison Company, and the organization of the board, Mr. George Bullock was re-elected president, Mr. Wetmore vice-president and W. F. White general manager. The contract for the storage battery, which is to be located in the cellar of the new Fifth street building, has been awarded to the Electric Storage Battery Company, of Philadelphia, at its bid of $10,000. Contracts for the generators, amounting to $78,000, were let to the General Electric Company, of Schenectady, N. Y., and for the engines, amounting to $10,000, to the E. P. Allis Company, of Milwaukee. Wires in the territory bounded by Third street, Broadway, the Canal and Central avenue will be placed under ground at a further cost of $10,000.

DRY DOCK WITH ELECTRICAL EQUIPMENT.—It is reported that a large new dry dock and shipyard are contemplated in South Brooklyn. A 600-foot dry dock will be built immediately, but it is intended to soon add 200 feet, so that it will have sufficient capacity to hold any ship afloat. It will be of the sectional type and operated throughout by electric motors. An independent electric power plant will be installed as well as an air compressing plant. The main machine shop, which will be 600 feet long by 80 feet wide, will be equipped with electric traveling cranes. Plans for the entire plant are about ready and specifications for the equipment are now being sent out. The work is being carried through by the Morse Iron Works and Dry Dock Company.

THE WESTERN ELECTRIC COMPANY has furnished the Metropolitan Traction Company of New York City a 300-kw 2500 ampere booster, said to be the largest of the kind ever built. The total output of the station is 8000 amperes. This current passes through the series windings of the booster. A 550-volt direct connected motor furnishes the power for driving the booster.

THE NEW ENGLAND MOTOR COMPANY, of Lowell, Mass., are doing a large and growing business in bipolar and multipolar motors and dynamos. In the two and a half years this company have been in business they have grown from a small shop to a three-story building, fully equipped with machinery of the latest design and all the modern appliances, which go toward making a complete factory. They have recently shipped one 45-kw machine to the South Middleton Paper Company, South Middleton, Mass., and another of the same capacity to the H. M. Plimpton Company, Norwood, Mass.

NEW PRICES FOR ALUMINUM WIRE.—The Pittsburg Reduction Company has just issued a new price list for aluminum wire, as follows: Brown & Sharpe's gauge, 0000 to 6, 39½c. per lb.; 7 to 8, 39¾c.; 9 to 10, 40c.; 11, 40½c.; 12, 41c.; 13, 41½c.; 14, 42c.; 15, 42½c.; 16, 43½c.; 17, 49½c.; 18, 54½c.; 19, 59½c.; 20, 64½c.; 21, 85c.; 22, $1; 23, $1.20; 24, $1.35; 25, $1.70; 26, $2. Six cents off list on 500 pound lots, 7 cents off on 20,000 pound lots; stranding, 1 cent additional per pound.

PITTSBURG INSULATING COMPANY.—On March 30 application will be made at Harrisburg for a charter of the Pittsburg Insulating Company. The company will erect a plant in conjunction with the Sterling Varnish Company. Insulating material for coating and varnishes will be made by a process, which the company controls by patents. The incorporators are: James Todd, Latimer S. Macan, Walther Riddle, E. Y. Breck and Edward B. Vail.

AMERICAN MACHINERY FOR JAPAN.—The Frick Company, of 39 Cortlandt Street, New York, has received an order for a complete ice making plant for the Kobe Electric Light & Power Company, of Kobe, Japan. This company also purchased five 100 horse-power boilers from the Frick Company. Mr. Enya, the chief engineer of the Japanese company, who was in this country for some time, placed the orders just before he returned to Japan.

MESSRS. MAGUIRE & BAUCUS, of No. 5 Warwick Court, High Holborn, London, W. C., a well known American electrical concern abroad, have just been appointed European agents for the Bridgeport Brass Company's line of cables, wire, etc., and will make a specialty of its "Phono-Electric" wire, which is now being very largely used here. Mr. Maguire, who has been in this country for several weeks, sailed for London Tuesday, March 13.

THE BIBB MANUFACTURING COMPANY, of Macon, Ga., will shortly erect a twenty-thousand spindle cotton mill at Columbus, Ga., for the manufacture of high-class goods exclusively. The Bibb Company, which is incorporated at $1,800,000 and owns a number of mills in Georgia, has secured control of the Columbus Power Company, an 8,000 horse power plant on the Chattahoochee River.

ELECTRIC THIRD RAIL & SIGNAL COMPANY.—A meeting of the stockholders of the Electric Third Rail & Signal Company was held in St. Louis on March 6. The following officers were elected: S. L. Swartz, president; George D. Harris, vice-president; B. Eiseman, secretary and treasurer. The officers with D. Wishart and T. J. Hoolan, constitute the new board of directors.

M. MAX TOURET, an electrical engineer from Paris, France, has spent several days in Cincinnati visiting the big plants making electrical apparatus and machine tools. He was particularly interested in the new Norwood plant of the Bullock Electric Manufacturing Company. Mons. Touret is posting himself on electrical engineering generally and getting pointers.

ELECTRIC EQUIPMENT FOR MANHATTAN.—The Manhattan Railway Company is in the market for four engines each to drive a 250-kw exciter. These machines will form a part of the company's electrical equipment. The engines needed will, of course, be of the high speed type.

I. P. FRINK reports four important contracts for the installation of his patent reflecting fixtures for electric lighting, in Paris, two of them being in connection with the Exposition. This is another instance of the success of American made goods in foreign countries.

THE NAVY DEPARTMENT has placed an order with the New York Air Compressor Company, 120 Liberty Street, New York, for two duplex compound air compressors of large capacity for the Charlestown Navy Yard, Boston, Mass.

PAYNE ENGINE PLANT BURNED.—Fire destroyed the plant of the Payne Engine Company, in Elmira, N. Y., on March 8, entailing a loss of $100,000. There was an insurance of $65,000.

Special Correspondence.

ENGLISH NOTES.

London Office, ELECTRICAL WORLD AND ENGINEER, March 3, 1900.

ELECTRIC LIGHTING.—At a meeting of the Edinburgh town council it was agreed to accept the following offers for additional generating machinery for the M'Donald Road electric lighting station: Mr. George Sinclair, boilers, £4800, and Mather & Platt, Salford, for the dynamos, £12,319. Bailie Mackenzie, convener of the Electric Lighting Committee, made a statement with reference to the cost of the undertaking. A fear had been expressed that undue capital expenditure was going on in the electric lighting undertaking of Edinburgh. The last published accounts showed that up to May last Edinburgh had expended £395,356, and had joined on to its system equivalent to 226,740 8-cp lamps, thus giving a capital expenditure of £1 15s. per lamp. Glasgow at the same time had spent £339,782, with 139,772 lamps joined on, giving a capital expenditure of £2 8s. per lamp. Dundee showed an expenditure of £1 13s. per lamp, Aberdeen £1 14s. 6d., Manchester £2, Liverpool £3 4s., Leeds £2 18s., Birmingham £2 10s., Sheffield £3, Dublin £2 14s., Belfast £2 8s., Brighton £2 4s. The large London companies showed an expenditure, as follows: The City Company (the largest in the country) had a capital expenditure of £3 18s. per lamp; the Metropolitan Company (the next largest), £2 12s.; Westminster Company, £2 6s. None had a smaller expenditure per lamp than Edinburgh.

GETTING LONDON READY FOR RAPID TRANSIT.—It is interesting to observe the work which the London County Council is carrying on from time to time to relieve the most important of the streets of the congested state of traffic, especially in the more central parts of London. This work, as is well known to most people who have ever visited London, has been going on for some years. One of the first and greatest improvements was the Thames Embankment and Queen Victoria Street. Since that day many others have been made, and most Americans who have visited this country are familiar with Charing Cross Road, a wide thoroughfare, which was put straight through the enormously congested district of small narrow streets lying between Charing Cross and Holborn. Several other localities in London show similar results, and when once the London County Council determine to make a road to relieve any particular district they hammer it straight through streets, property, buildings and everything which may stand in the way, the result generally being a wide and comfortable thoroughfare. The Strand and Fleet Street have both been a source of great difficulty to the London County Council for some years, and whenever an opportunity occurs for securing property on either one of these two thoroughfares it is immediately taken possession of. The London County Council has now purchased the entire property between two churches forming the north side of the Strand. The work of tearing down this entire block of old buildings has been commenced, and this will give an additional width to the Strand at this part of 100 to 150 feet and will serve to considerably relieve the traffic. It need hardly be said, however, that if the London County Council could only make up their minds to allow electric tramways to come into the city of London proper, it would be a much more effective way of relieving the congestion in the streets. At Ludgate Circus also the same class of work is being carried on, and old buildings at the entrance to Fleet Street are being torn down and new ones erected, giving an additional width to the street of about 15 feet. It is also the intention of the council to make a new road, which has not as yet been given a name, leading from the Strand in the vicinity of the portion referred to, and which is being torn down and very nearly opposite the head of Norfolk Street, in which these offices are situated, leading straight through a maze of small streets and back slums up to Holborn. It may not be at once apparent to our readers what all the above has to do with electric news, but if one will only think what a splendid opportunity there is in London for electric railways or tramways every step which a congested city makes to widen and improve its streets, and hence improve transport, must be of interest to the electrical engineer.

General News.

THE TELEPHONE.

TYNDALL, S. D.—A telephone exchange is to be established here.

AMBLER, PA.—The Ambler Telephone Company has been incorporated, with a capital stock of $5000.

DES MOINES, IOWA.—A bill has been introduced in the legislature providing for assessment of telephone and telegraph companies.

RICHMOND, VA.—A bill has been introduced in the senate to incorporate the Colburn, Clinch Valley & Nickelsville Telephone Company.

GRAND RAPIDS, MICH.—The Citizens' Telephone Company, of Grand Rapids, has increased its capital stock from $300,000 to $500,000.

GAINESBORO, TENN.—It is understood that the Gainesboro Telephone Company has bought out the new company recently organized at Cookeville.

HUNTSVILLE, ALA.—The Independent Telephone Company has awarded contracts for the surveying and building of the new telephone exchange here.

MANCHESTER, N. H.—The New England Telephone Company will move its exchange to the Merrill block, where it will have more commodious quarters.

LUCAS, OHIO.—The Monroe Telephone Company, of Lucas, has been incorporated. Capital, $900. Incorporators, H. H. Kayler, C. Beasore, E. Sheets, I. N. Emsberger.

RICHMOND, VA.—Bills have been introduced in the senate for the incorporation of the Herndon & Leesburg Telephone Company and the New River Telephone Company.

CRESCO, IOWA.—The Northern Iowa Telephone Company has been incorporated here. Capital, $20,000. Incorporators, O. G. Wanless, C. S. B. Carpenter, both of Cresco.

ROCKFORD, OHIO.—The Rockford Telephone Company has been incorporated by A. J. Vernier, G. H. Probeck, L. A. Burgess, W. T. Barbour, J. Loyd. Capital, $10,000.

ALBANY, N. Y.—The Central New York Telephone & Telegraph Company, whose principal headquarters are in Utica, has increased the number of its directors from seven to nine.

BOSTON, MASS.—The New England Telephone & Telegraph Company has withdrawn its opposition to the proposed measure for state supervision of telegraph and telephone companies.

THE PACIFIC COAST TELEPHONE SYSTEM made a net gain of 2321 Bell subscribers in February; total number connected March 1 was 69,014, of which 17, 941 are in San Francisco.

SIOUX CITY, IOWA.—The Iowa Telephone Company is enlarging its switchboard and present indications are that the consolidation of the Iowa and Home exchanges will be completed April 1.

MOLINE, ILL.—It is probable that measures will be taken at once to compel the Central Union Telephone Company to place its wires in underground conduits in the business districts of this city.

INDIANAPOLIS, IND.—The Central Union Telephone Company pays the city $6000 per year for its underground privileges. Last week is made its semi-annual settlement, paying $3000 into the treasury.

VERSAILLES, OHIO.—The Versailles Home Telephone Company has been incorporated. Capital, $10,000. Incorporators, A. J. Verwier, G. H. Robeck, L. L. Thoman, J. P. Rorick, M. C. Rorick.

ADRIAN, MICH.—The directors of the Citizens' Telephone Company have decided to increase the capital stock from $20,000 to $40,000, and extend its rural service for which there is a growing demand.

TERRE HAUTE, IND.—The Citizens' Telephone Company is soliciting subscribers for the independent exchange. The rentals have been fixed at $30 for business houses, and $18 for residence service.

BOUND BROOK, N. J.—Owing to the failure of the council committee to report the telephone ordinance, the New York & New Jersey Telephone Company has been delayed in the completion of its work here.

ANTWERP, OHIO.—The Antwerp Telephone Company has been incorporated with a capital of $10,000. Incorporators: A. J. Vernier, C. M. Laughlin, H. T. Murphy, T. O. Harris, F. D. Graves, G. H. Probeck.

OTTUMWA, IOWA.—A new independent telephone movement has been commenced in Iowa. New companies are being organized to take the place of those companies which have been absorbed by the Bell Company.

LINCOLN, NEB.—The Nebraska Telephone Company, a Bell concern, is likely to meet with strong opposition in southeastern Nebraska, where independent companies have organized and are competing for business.

NEWTON, ILL.—Local telephone owners held a meeting recently. Messrs. Frank L. Sharp, John H. Larrabee and H. M. Chamblin were appointed a committee to ascertain the cost of various contemplated improvements in the service.

RICHMOND, VA.—State Treasurer Worth has received a check for 10 cents from the Air Bellono Telephone Company, of Sparta, N. C., being the amount of the company's 10 per cent. tax on gross earnings as reported by its officers.

BRISTOL, TENN.—The Postal Telegraph Company has tested the telephone wires of the East Tennessee Telephone Company and found that they can be made to do the double duty of transmitting telephone and telegraph messages.

NEWARK, N. J.—The North Jersey Telephone & Telegraph Company has been incorporated, with headquarters here. Capital, $15,000. Incorporators, Union N. Bethell, Walter Brown, John J. Cahill, Joseph Kavanagh, Howard F. Thurber.

BOZEMAN, MONT.—The West Gallatin Irrigation Company will put in a complete telephone system along the line of their canal this spring. It will terminate at Manhattan, near the end of the 57 miles of ditch, and a branch may be run into Bozeman.

MIFFLIN, OHIO.—The Mifflin & Widoville Telephone Company has been incorporated. Capital, $1,000. Incorporators: W. T. Wilson, H. E. Echelberger, J. H. S. Hutchinson, J. H. Snyder, W. C. Haskins, J. M. Campbell, W. Latimer, G. Thomas, P. Byerly.

DES MOINES, IOWA.—The Clarion & Northwestern Telephone Company of Clarion has been incorporated, with a capital of $10,000. Incorporators: E. A. Alexander, C. F. Peterson, C. D. Young, F. C. Hartshorn, W. W. Courson, E. S. Frank, C. B. White, all of Clarion.

SHEBOYGAN, WIS.—Judge Kirwan, of the circuit court, issued a writ of mandamus on the Mayor and City Council of Sheboygan, compelling them to grant a franchise to the telephone company on or before March 20, or show cause why they should not be fined for contempt.

KENOSHA, WIS.—A number of the farmers living in the western part of Kenosha County have formed a company and in the early spring they will build a telephone line connecting all the outlying villages in the county. It will also be connected with the lines of the Wisconsin Company.

WILKESBARRE, PA.—The Farmers' Telephone & Supply Company has been incorporated here. Capital, $2000. Incorporators, J. T. Lanahan, C. F. McHugh, E. F. McGovern, all of Wilkesbarre; C. A. Long, of Mulenberg; B. F. Croop, of Hemlock Creek; G. W. Callender, of Sweet Valley.

KANSAS CITY, MO.—Martin Maloney, W. H. Eckert and J. B. McCall, of the Telephone, Telegraph & Cable Company, of New York, have applied to the city council for a franchise for a competing telephone system here. They pur-

pose to cut prevailing rates from $96 a year for long distance business service to $48, and for residences from $72 to $36.

MOUNDSVILLE, W. VA.—The Exchange Telephone Company, which lately built a line from Littleton to the Ohio River, will be connected with the Panhandle system in this city. The Exchange Company has connections with about 8,000 places in various counties of this state and Southwestern Pennsylvania.

LINCOLN, NEB.—The Supreme Court of Nebraska has just decided that the act of the legislature giving the state board of transportation the right to regulate telephone rates is constitutional. It is predicted that a sweeping reduction of rates will be ordered, as a plank in the populist platform declared for a reduction.

RICHMOND, IND.—A rate war between the Central Union and Home Telephone companies of this city is imminent. The Home Company has in operation more than 1000 instruments, many of them in private residences. The Central Union now has a special and very suave solicitor on the ground and is offering residence service for 50 cents per month.

WEYAUWEGA, WIS.—For the purpose of forming an association of all the independent telephone companies in the State of Wisconsin, a meeting has been called to be held at Weyauwega, March 20 and 21. By building a few connecting toll lines, the 75 independent companies will form one system that will be a formidable rival to the Wisconsin Telephone Company.

SHIEDLER, IND.—The farmers in this vicinity have organized an independent telephone company, and the adjoining communities are preparing to do the same. The list of the subscribers number 150 names. A regular exchange with a single switchboard will be established. The promoters claim that the cost to farmers will be but a few dollars a year.

EATON, OHIO.—The citizens and farmers in the country surrounding New Lebanon have organized a local independent telephone company. A switchboard with a 50-drop capacity will be used at New Lebanon to take care of the local subscribers. A trunk line will be built to Farmersville, there connecting with lines now in operation to Germantown, Ingomar, Winchester and Eaton.

SCRANTON, PA.—The Lackawanna Telephone Company has decided to solicit subscribers and has ordered the material for the conduits and wires. The company will connect with the independent companies in Carbondale and Wilkesbarre. Arrangements for connecting with the Telephone, Telegraph & Cable Company of America, so as to secure long distance service, are also being made.

PARKERSBURG, W. VA.—Representatives of 30 West Virginia independent telephone companies met the officers of the National and United States Telephone companies of Ohio, in this city, and made plans for a working arrangement between the independent telephone companies of Illinois, Indiana, Ohio and West Virginia. It was agreed to open the main long distance telephone exchange of the combination in Ohio at Marietta and that of West Virginia in this city.

SALT LAKE CITY, UTAH.—At the annual meeting of the Rocky Mountain Bell Telephone Company, held here, the following directors were elected: George Y. Wallace, G. M. Downey, C. W. Lyman, Maj. H. C. Hill, Thomas Marshall, W. J. McCormick, C. F. Lloyd, C. J. French and Alonzo Burt. The directors have chosen the following officers: President, George Y. Wallace; vice-president, G. M. Downey; treasurer, C. W. Lyman; secretary, W. H. Hill; Executive Committee, George Y. Wallace, G. M. Downey, H. C. Hill, W. J. McCormiok and Alonzo Burt.

PHILADELPHIA, PA.—Arrangements have been completed for the purchase of the Maryland, Pennsylvania & West Virginia Telephone Company, the Greensburg Telephone Company and the Home Telephone Electric Company. It is reported that the Pittsburg & Allegheny Company will be taken into the arrangement at an early day. The Telephone, Telegraph & Cable Company, which is the merging concern, will control the telephone lines centering in Fort Wayne, Ind., which are operated by the National Telephone & Telegraph Company. This system reaches out into Northern Ohio as well as into Southern Indiana.

CLEVELAND, OHIO.—The Home Telephone Company, of La Porte, Ind., has filed a mortgage with the Cleveland Trust Company, this city, for $100,000. The mortgage is secured by gold interest bearing bonds drawing 5 per cent. per annum, made payable Jan. 1, 1920. The company mentioned is composed of Ohio capitalists, and it has recently bought the Elkhart telephone exchange and an exchange at Goshen. It is the purpose to operate exchanges in the different towns in Elkhart County, Ind., and to build and maintain toll lines in Noble, Lagrange, Kosciusko, St. Joseph and Elkhart Counties in connection with independent lines in Ohio.

CLEVELAND, OHIO.—The lines operated by the Geauga County Telephone Association have just been placed in connection with the Cleveland city lines of the Cuyahoga Telephone Company. The association mentioned includes the independent exchanges of the Chardon Telephone Company, the Bainbridge Telephone Company, the Burton Telephone Company, and the Stafford Telephone Company, composing one of the most complete farmer's systems in the country. The association was formed last fall, the territory divided and arrangements made for exchanging subscribers' lists, so that each company has the benefit of the other's service at its own rates. The association now has about 500 subscribers, the uniform rate being $12 per year, and the subscribers are now given the benefit of city communication.

PHILADELPHIA, PA.—Six ordinances, repealing telephone privileges granted to as many companies in this city, have passed both branches of councils. This action is regarded as the first step toward the entrance into Philadelphia of the new Telephone, Telegraph & Cable Company of America. The only company whose ordinance was repealed that has anything in the way of a plant is the Standard, which has spent about $100,000 for laying conduits. It has been suggested that the new company may purchase this plant. The companies whose privileges were repealed were the Clay Commercial Telephone Company, Mutual Automatic Telephone Company, People's Telephone Company, Baxter Overland Telephone & Telegraph Company, Philadelphia Standard Telephone & Telegraph Company, and the Drawbaugh Telephone & Telegraph Company.

ELECTRIC LIGHT AND POWER.

ALLIANCE, OHIO.—This city will issue $35,000 electric light bonds.

SAGINAW, MICH., will issue $75,000 4 per cent. municipal lighting bonds.

OWENSBORO, KY.—The city has decided to issue $40,000 bonds to establish an electric light plant.

CLINTON, WIS.—It is proposed to bond the village for $5,000, to put in an electric light plant.

BURLINGTON, IOWA.—The Burlington Railroad is equipping its passenger locomotives with electric headlights.

NORTHPORT, L. I., N. Y.—The Northport Electric Light Company has declared a dividend of 3 per cent. on its capital stock.

COQUILLE, ORE., will be lighted by electricity this summer, a city lighting contract having been assured to the projectors of the plant.

CENTRALIA, ILL.—The city council has decided to not lease the electric lighting plant to W. I. Lane, but to engage him to run the plant at a stipulated salary.

BAY CITY, MICH.—The Bay County Electric Company will build a power house at Bay City, which, with proposed equipment, will cost from $30,000 to $50,000.

SCRANTON, PA.—The Scranton Electric Light & Heat Company was awarded the contract to light the city streets for a period of 20 years at 20 cents per light.

NORFOLK, VA.—The Norfolk Heat & Power Company has filed a bond in $10,000, binding themselves to begin the erection here within four months of an electric plant.

OMAHA, NEB.—The new Omaha Thomson-Houston Electric Light Company is remodeling its plant, and by May 1 will have one of the most complete plants west of Chicago.

MANCHESTER, N. H.—The Manchester Electric Light Company has increased its stock. The records now show the company to be capitalized at $1,000,000, an increase of $400,000.

LOUISVILLE, KY.—It is stated that the city will build a lighting plant of its own, and the owners of the present plant will dispose of theirs when their present contract expires in July.

JERSEY CITY, N. J.—A two-story brick and iron power house will be erected at Bayonne, N. J., from plans recently completed in the office of Tuthill & Higgins, of Jamaica, N. Y.

OWENSBORO, KY.—Since the city council passed an ordinance to build a $40,000 electric light plant the old company has made a proposition to sell its complete plant to the city for $25,000.

ALLIANCE, OHIO.—At a special election held last week, a proposition to bond the city for $35,000 for the erection of a municipal lighting plant for public and private lighting, was carried by a large majority.

CHARLESTON, ILL.—The Charleston Thomson-Houston Electric Company has changed its name to Charleston Light, Heat & Power Company, and its capital stock has been increased from $40,000 to $80,000.

CARMICHAELS, PA.—The Carmichaels Heat, Light & Power Company, with a capital of $1000, has been in corporated by C. J. Lincoln, L. Myers, F. Blackshore, S. S. Bayard, T. L. Lincoln, all of Carmichaels.

VISALIA, CAL.—The Mt. Whitney Power Company, of Visalia, has been incorporated. Capital, $300,000. Incorporators, W. H. Hammond, A. G. Wisbron, R. P. Hammond, B. M. Maddox, S. Mitchell, all of Visalia.

NEWARK, N. J.—The People's Electric Light & Power Company, of New Jersey, is absorbing all the 13 smaller companies in Hudson and Essex counties, and it will in turn combine with the United Electric Company.

MORELIA, MEXICO.—The electric light plant in this place is being improved in several important respects. The power house is being enlarged and 40 additional arc lights and 1000 incandescent lights are being put in.

WASHINGTON, D. C.—A bill has been introduced in the senate providing for the removal of overhead telegraph and telephone wires, and for the construction of conduits for the reception of the same in the District.

CAMERON, TEXAS.—The electric light plant of Goldthwaite Bros., at Cameron, Texas, has just been sold to the Cameron Water, Light & Power Company. The purchasers are to take possession of the plant on May 15.

NIAGARA FALLS, N. Y.—Three new transformers, designed to be used in connection with the transmission of power from the New York to the Canadian side at Niagara Falls, have arrived at the Falls and will be installed at once.

KLAMATH FALLS, ORE.—The Link River Power Company, of Klamath Falls, has been incorporated to operate an electric light and power plant. Capital, $3000. Incorporators, J. F. Goeller, R. W. Marple, E. B. Henry.

PITTSBURG, PA.—The Northeastern Heat, Light & Power Company, of Pittsburg, has been incorporated with a capital of $1000. Incorporators: W. J. Smith, W. J. Hogan, J. Y. Daly, W. G. Weimer, J. F. McCartney, all of Pittsburg.

TELLURIDE, COLO.—The Penn Power Company, of Telluride, has been incorporated to furnish electrical power. Capital, $100,000. Incorporators, G. T. Simonton, F. L. Butterfield, both of Telluride; F. L. Pruyn, F. B. Hunter, both of New York.

MT. HOLLY, N. J.—Articles of incorporation of the Hammonton (Atlantic County) Electric Light Company, capital $25,000, have been filed in the county clerk's office here. The two incorporators are Francis J. Thron and Charles C. Gallagher, of Beverly.

YONKERS, N. Y.—At a special meeting of the common council the committee on lamps reported in favor of an act to be submitted to the legislature authorizing the common council to establish a municipal electric light plant at a cost not to exceed $175,000.

STEUBENVILLE, OHIO.—A committee composed of three councilmen and three citizens of Steubenville, Ohio, has been appointed to confer with the

board of directors of the Steubenville Electric Light Company, with a view of purchasing the plant for the city.

COLUMBUS, IND.—This city's experiment in municipal ownership of its electric light plant has proven highly economical, as a saving of $30,000 since its establishment proves. The plant is operated in connection with the water works.

ST. LOUIS, MO.—The board of public improvements, March 3, ordered a reletting of the contract for lighting the business portion of the city, which was forfeited by H. R. Budd, of Bunker Hill, Ill., March 2. The date for the reception of bids was fixed for March 20.

CINCINNATI, OHIO.—Temporary alternators to serve the residence portion of Cincinnati will be installed by the Cincinnati Edison Electric Company. The dynamos are of 2000 light capacity each, and when connected up are expected to take care of 16,000 lights.

CHICAGO, ILL.—President Billings, of the Peoples Gas Company, Chicago, admits the probability of the company losing the contract for lighting the city's streets on account of a proposition to extend the city's electric light plant so as to enable it to light the entire city by electricity.

MT. VERNON, ILL.—At a meeting of the city council March 1 the contract with the Mt. Vernon Electric Light Company was renewed for a period of six years for 50 or more arc lights at the uniform price of $85 per light on an all-night schedule. Under the old contract the city pays $90 per light.

ANNAPOLIS, MD.—A bill was introduced in the senate empowering the people of Baltimore city to vote to issue stock to the amount of $1,350,000 for the purpose of constructing a municipal electric plant whenever the mayor and city council shall deem it advisable to lay the matter before the people.

CHESTER, W. VA.—The Chester Light & Power Company, of Chester, has been incorporated. Capital, $200,000. Incorporators, C. A. Smith, of Pittsburg, Pa.; A. G. Mason, W. L. Smith, J. E. McDonald, all of East Liverpool, Ohio; J. A. Flood, of Allegheny, Pa.; A. G. Mason, attorney, East Liverpool, Ohio.

ONANCOCK, VA.—The bill incorporating the Drummondtown and Onancock Electric Light & Power Co. has been passed by the Virginia legislature. It is said that it is the purpose of the incorporators to operate an electric railway. Among the incorporators are J. P. L. Hopkins, R. L. Hopkins, O. L. Parker, S. K. Powell, James H. Fletcher, J. C. Justice and Spencer F. Rodgers.

ST. CLOUD, MINN.—Mr. C. S. Benson, general manager of the St. Cloud Water, Light & Power Company, has been appointed receiver of the St. Cloud Gas & Electric Company. This came as somewhat of a surprise to the citizens of this place as it was not generally known that the latter company was in financial straits.

SAN FRANCISCO, CAL.—All street lights in San Francisco, Cal., are now extinguished at 12 midnight. This is the result of a compromise measure passed by the supervisors for the purpose of reducing the city's expenses until next July. The proposition to suspend street lighting altogether met with too many protests from the citizens.

ST. PAUL, MINN.—The Commercial Light & Power Company was placed in the hands of receivers for the purpose of reorganizing the company. The receivers appointed were A. W. Hartman, president of the company, and Robert R. Dunn, treasurer. The reorganization, it is said, will not affect the management or business of the company in any way.

SAN FRANCISCO, CAL.—The United States Army General Hospital at the Presidio, San Francisco, will be lighted by an isolated electric plant. Bids were recently received for steam and electric installations for heating and power purposes. Two marine-type generating sets, each of 40-kw capacity, were called for by the specifications. The contracts will be approved in Washington, D. C.

JERSEY CITY, N. J.—It is understood that the National Power & Manufacturing Company formed a few days ago with a capital of $2,000,000, is connected with the street and electric light companies with which James C. Young and Bernard Shanley, of Jersey City, are connected. The National Power & Manufacturing Company will operate all the different electric plants which are now operated to supply power to the North Hudson Street Railway Company and the electric plants of Jersey City and Newark.

DAYTON, OHIO.—The city council has authorized advertising for bids for electric lighting. Bids shall be for from 400 to 600 arc lamps for five or ten years. The lights must be of 2000-cp per arc light of not less than 450 watts, tests to be made from time to time by the city. The successful bidder, if a new company, must make application for a franchise. The Dayton Electric Light Company has held the contract for a number of years.

PORTSMOUTH, N. H.—At the annual meeting of the Portsmouth Gas, Electric, Light & Power Company the following officers were chosen: Directors, H. Fisher Eldredge, William W. Cotton, John M. Cheever, Calvin Page and Frederick M. Sise; president, H. F. Eldredge; vice-president, William W. Cotton; clerk and treasurer, Hiram B. Lord; superintendent gas division, Thos. R. Martin; superintendent electric division, Albert Lee.

CITY OF MEXICO, MEX.—The Mexican government has granted a concession to W. W. Price, an American, to use the waters which spring from the Cerro de Teotepec, near Chilpancingo, in the state of Guerrero, for electric power for operating the machinery in his mines and reduction works near that place. Prof. W. Niven, of New York City, has also been granted a concession for the use of the waters of the Campo Morado River, near Otatlan, for the same purpose.

WASHINGTON, D. C.—The district commissioners have submitted a report on house bill 7086, to reduce the price of electricity in the district. The bill proposes that local electric light and power companies shall furnish to the public and private consumers in all parts of the district standard arc lights of not less than 1000 actual candle-power at a rate not exceeding $60 per annum, and that on and after July 1, 1900, the maximum price for electric current sold or furnished to any consumer in the district shall be reduced from the present maximum of 10 cents per kilowatt hour to not exceeding 6 cents per kilowatt hour.

THE ELECTRIC RAILWAY.

DULUTH, MINN.—Thomas Lowry, of Minneapolis, has purchased the Lakeside Street Railway.

JEFFERSON CITY, MO.—The Sedalia Street Railway system has gone into the hands of a receiver.

PITTSBURG, PA.—The project to construct a traction line from Pittsburg to Cleveland now looks as if it may go through.

CADIZ, OHIO.—Harrison County has granted to J. A. White the franchise for an electric railroad connecting Wheeling and Cadiz.

FAYETTEVILLE, N. C.—Mr. J. W. McNeill, of Fayetteville, N. C., has recently secured a franchise to build an electric railway here.

JACKSON, MICH.—The Jackson Street Railway Company has under consideration a number of important improvements on its system.

PHOENIXVILLE, PA.—The Phœnixville & Bridgeport Electric Railway Company has secured the right of way from Phœnixville, Pa., to Valley Forge.

HAVERHILL, MASS.—The Haverhill, Georgetown & Danvers Street Railway Company's car barn at Georgetown was burned recently, causing a loss of $25,000.

SHARON, PA.—The Youngstown & Sharon Street Railway Company has commenced the work of securing the right of way between Hubbard and Sharon.

RICHMOND, IND.—Henry G. Pruden, representing New York capitalists, has asked for a franchise for an electric railway from this city to various towns in this vicinity.

FRANKLIN, TENN.—Application for a right of way will be made by the parties interested in the construction of an electric car line from Nashville to Franklin.

ALBANY, N. Y.—An ordinance will be introduced in the city council authorizing the city to issue bonds for $250,000 for the construction of a municipal electric light plant.

AMESBURY, MASS.—The Lynn & Boston Railroad Company has secured control of the Wakefield & Stoneham, the Wakefield & Salem and the Gloucester electric railroads.

DETROIT, MICH.—The Michigan Traction Company, of Kalamazoo, has filed a mortgage to secure $600,000 bonds floated by the American Trust Company, of Philadelphia.

SILVER LAKE, IND.—A franchise has been granted to G. H. Lessing and others for an electric interurban railway. It is believed that the Union Traction Company is behind the scheme.

BEAVER DAM, MINN.—The franchise recently granted by the city for a new electric light plant has been sold to T. D. Lawrence, Jacob Martin, Jr., and George R. Congdon, all of this city.

HALIFAX, N. S.—The Demerara Electric Company has ordered a 300-hp engine from the Robb Engineering Company, Amherst, N. S., for an electric street railway at Georgetown, British Guiana.

NEW BRITAIN, CONN.—The New Haven Railroad is experimenting with the third rail system for heavy traction. Experimental rails are being laid from New Britain, Conn., toward Middletown, Conn.

HARTFORD, CONN.—The People's Tramway Company, organized to operate an electric road at Danielson, Putnam and through that section, contemplates important operations this season.

NEWARK, OHIO.—A movement is on foot to combine the Newark Central Electric Street Railway Company, the two electric light companies and the artificial gas company by some foreign capitalists.

DICKSON, TENN.—Luke T. Walker, of Nashville, is negotiating with the city council for the erection of an electric light plant for the town. The probability is that his proposition will be accepted.

PITTSBURG, PA.—The United Traction Company, of this city, has completed plans for the erection of a new car barn at McKeesport, at a cost of $60,000. The building will be entirely of steel.

BATTLE CREEK, MICH.—This city is to be the terminus of another interurban electric railway. Parties are now securing the right of way for a line running south to Burlington, Union City and to Coldwater.

DOVER, DEL.—The Delaware General Electric Railway Company has been organized. The road, which is both freight and passenger, has a total of 45 miles. Starting at Dover it will extend southward to Milford.

IRONTON, W. VA.—The Ironton Electric Light & Railway Company's property will be sold at public auction on March 14. The plant is valued at $100,000 and ex-Senator Camden is named as the probable purchaser.

NEW BRUNSWICK, N. J.—The Raritan Traction Company, with a capital of $1,000,000, has been incorporated in New Brunswick, N. J. The company will operate the trolley road which is being constructed at Perth Amboy.

WILMINGTON, DEL.—The Ohio River Electric Railway & Power Company has been incorporated. Capital $300,000. Incorporators: M. N. Willits, of Middletown, Del.; J. E. Janney, J. C. Moore, Jr., both of Philadelphia, Pa.

INDIANAPOLIS, IND.—The Indiana & Ohio Traction Company has been incorporated with a capital stock of $300,000. The ojcers are: J. M. Gore, president; E. L. Mason, vice-president; W. L. Adams, secretary and treasurer.

WOONSOCKET, R. I.—It is stated that the New York, New Haven & Hartford Railroad Company has purchased the controlling interest in the stock of the Webster & Dudley and the Worcester, Oxford & Webster electric railways.

CLEVELAND, OHIO.—Councilman Goodwin has been studying the conduit electric railway systems in New York City, and will introduce an ordinance that future franchises, which will be taken up next spring, shall be for the conduit system only.

TOLEDO, OHIO.—Suit was brought against the Toledo Traction Company by the city of Toledo for 1 per cent. of the gross earnings of that portion of the Toledo street car system formerly known as the Robison lines. It is estimated that the sum at stake will exceed $100,000.

McKEESPORT, PA.—The Boston Bridge Company has awarded the contract to raise its bridge across the Youghiogheny River. When completed it will make a continuous street car line from Pittsburg to Buena Vista, a distance of 26 miles, with but one change of cars.

DALLAS, TEX.—A franchise was granted to George T. Bishop and others of Cleveland, Ohio, for an electric line in the southeastern part of the city. This line is to connect with the Inter-Urban Electric Railroad between Fort Worth and Dallas. The franchise is for fifty years.

TOLEDO, OHIO.—The Toledo Traction Company has let the contract for generators and boilers, to be placed in the new addition to its power house. The boilers will be supplied by Allis & Co., of Milwaukee, and the generators by the General Electric Company. The contracts aggregate $87,000.

CHICAGO, ILL.—Mayor Harrison has taken up the subject of downtown subways for traffic and announced that he would undertake to get a practical plan of operation under way. With that end in view he is preparing a report to the city council in which he will urge that the subject be considered at once.

RICHMOND, VA.—The Virginia Electric Railway & Development Company will ask the city council of Manchester the right to extend its lines through the city. The company proposes to enter into the street and house lighting business and also to furnish power. Bids will be made for the city lighting.

COLORADO SPRINGS, COL.—The promoters of the Citizens' Light, Heat & Power Company are making preparations to start work at once upon the approval by the people, which they expect will be given April 3, when a special election will be held. It is proposed to expend in the neighborhood of $200,000 upon the plant.

PHILADELPHIA, PA.—Pepper & Register have begun suit against the Philadelphia & West Chester Traction Company and the Philadelphia, Castle Rock & West Chester Railway Company to recover $19,536.15, alleged to be due under the contract for the construction of the trolley road between this city and Chester.

LEBANON, ILL.—The citizens of this place have organized a commercial club with the general object of advancing all commercial interests of the city, but for the immediate purpose of encouraging the building of an electric road to St. Louis. An executive committee has been appointed to form plans for immediate action.

PUEBLA, MEX.—Some extensive improvements are to be made immediately in the Puebla Street Railway system and the Industrial Railway of the City of Puebla. Mr. Frank Barnard is general manager of the Puebla systems. It is likely that these systems and that in Guadalajara will be converted into electric lines at an early date.

NEW BRUNSWICK, N. J.—The Raritan Traction Company filed articles of incorporation with a capital of $1,000,000. It is to operate and extend the trolley lines in course of construction at Perth Amboy. The incorporators are James C. McCoy, of Perth Amboy; Edward Q. Keasbey, of Morristown, and George M. Keasbey, of Newark.

BUFFALO, N. Y.—The Buffalo Railway Company has sent the treasurer of the Pan American Exposition a check for $20,000; the Buffalo & Niagara Falls Railway has sent a check for $3000, and the Buffalo & Lockport Railway Company has sent a check for $1000. These checks make the railways square on their subscriptions to the exposition.

WILMINGTON, DEL.—The Wilmington & Brandywine Springs Railway Company has awarded the contract for the erection of a power house, at Elsmere, to William H. Greenwalt & Son. Provision will be made for three boilers, three engines and three dynamos. Sterling boilers are to be used and the electrical machinery will be furnished by the General Electric Company.

ALBANY, N. Y.—The state railroad commission has granted an application of the DeKalb Avenue & North Beach Railroad Company for permission to lay tracks on that portion of its route in Stanhope Street between Covert Avenue and Metropolitan Avenue, Brooklyn Borough, New York City. The new line is to be operated by the Coney Island & Brooklyn Railroad as a part of its system.

HAVRE DE GRACE, MD.—A bill has been introduced in the legislature to incorporate the Belair & Havre De Grace Railway & Power Company. The incorporators are Messrs. Hanson H. Haines, John H. Record, William E. Robinson, W. Beatty Harlan, James R. Massey, Thomas MacKenzie, Noble L. Mitchell and Harry E. Kerr. The capital stock is to be $10,000, with power to increase it to $500,000.

RICHMOND, VA.—The ordinance passed by the city council prescribes what taxes and what consideration for the privileges granted by said ordinance shall be paid by the Richmond Traction Company. The company is to pay annually 3½ per cent. on all gross earnings of traffic until they shall reach $200,000, then all above that amount up to $300,000 the tax shall be 5 per cent.; 7 per cent. on all gross earnings up to $400,000.

ST. LOUIS, MO.—The St. Louis & Suburban Railway Company advanced the salaries of all its employees, 750 in number, 10 per cent. for the past two weeks of February, on account of the hardships entailed by bad weather and the good work accomplished. The St. Louis Transit Company also granted its employees extra pay for work last month. Each employee received 75 cents extra for work on the night of the storm, Feb. 28.

PHILADELPHIA, PA.—At a meeting of the directors of three traction companies in New Brunswick, N. J., recently it developed that almost a complete chain of trolleys had been perfected from New York to this city. A portion of the track is not yet laid, but franchises have been secured quietly for the past two years in piecemeal, so that it will, in a short time, be possible for a person to get in a car at Jersey City and ride direct to Philadelphia.

CHATTANOOGA, TENN.—The Chattanooga Rapid Transit Company has recently acquired several important suburban lines, and it is understood intends improving them and building several extensions. The Chattanooga Electric Railway Company, it is stated, has determined to extend its lines to Sherman Heights, also Rossville, in the suburbs, and will enlarge its power house, adding a 450-hp engine. The company has also placed an order for 10 miles of rails and 16 cars.

DETROIT, MICH.—C. H. White & Co., New York bankers, have purchased the entire $1,250,000 bond issue of the Detroit, Rochester, Romeo & Lake Orion Electric Railroad, taking at once the bonds now issued and owned by John Winter, Frank C. Andrews and Oliver H. Lau, and also the remainder of the bonds when issued on the continuation of the system from Oxford to Flint. The American Trust and Savings Bank, of Chicago, will act as trustee of the bonds in connection with the Guarantee Trust Company, of New York.

CHICAGO, ILL.—In a recent opinion of the Appellate Court it is held that the depreciation of property values through the erection of an elevated railway structure on a public street is sufficient cause for a suit for damages. This ruling was given in the case of the Chicago Office Building Company against the Lake Street Elevated Railroad Company in the former's suit for $100,000 damages for injury to the value of the Ogden building, owned by the plaintiff. The far-reaching effect of the decision will be apparent, because there are pending hundreds of similar suits against the elevated railways.

JERSEY CITY, N. J.—The newly organized Ridgefield & Teaneck Railway Co. has been merged with the Bergen County (N. J.) Traction Co., which runs a trolley line from Fort Lee. The union was made under the name of the Hudson River Railway & Ferry Company, with $1,500,000 capital. Among those who join in this latest trolley deal are William Clarke, of Philadelphia, who owned the Bergen County Traction Company; C. A. Lieb, of the Washington (D. C.) Traction Company; Abram White, of New York; Alexander Taylor, of Philadelphia, and James C. Young, of Jersey City. The Fort Lee Ferry Company was also purchased by this trolley combination.

CANAL DOVER, OHIO.—Local capitalists here are engineering a plan to make a continuous trolley line across Ohio from Lake Erie to the Ohio River. There is at present an electric line from Cleveland to Akron. Right of way has been secured from Massillon to this city. From here to Uhrichsville, 13 miles south, a trolley line has been in operation for several years. Between Uhrichsville and Cadiz right of way has already been bought up and a survey for the line made. From Cadiz to Wheeling there is already a line in operation. The untracked portions are between Akron and this city and between Uhrichsville and Cadiz. Of this route all has been provided for except between Akron and Massillon.

ALBANY, N. Y.—The Rapid Transit Subway Construction Company, of New York City, has been incorporated with a capital of $6,000,000, all common. The company proposes "To construct or aid in constructing and equipment of rapid transit railroad in New York City authorized by Chapter 4, Laws of 1891, and its amendments." Duration of company's existence is perpetual. Directors are: William H. Baldwin, Jr., and James Jourdan, of Brooklyn; Gardiner M. Lane, Cambridge, Mass.; Chas. T. Barney, August Belmont, Geo. Coppell, E. Mora Davidson, Andrew Freedman, Walter G. Oakman, John Peirce, Wm. A. Read, Cornelius Vanderbilt, Geo. W. Young, of New York.

THE AUTOMOBILE.

AN AUTOMOBILE CLUB is to be organized in Minneapolis, Minn. Mr. E. J. Phelps is one of the active promoters of the club.

THE BOSTON WOODS MOTOR VEHICLE COMPANY has been incorporated in Boston by S. L. Powers, H. W. Mason and F. J. Crolius. The capital is $300,000.

THE OAKUM MOTOR VEHICLE COMPANY has been incorporated in Jersey City, to deal in motor vehicles, etc. Capital, $600,000. Incorporators, I. N. Ames, G. W. Litterest, J. V. Clark, all of Jersey City; H. F. Neefus, attorney, New York City.

THE GEORGE F. BRANDENBURG COMPANY has been incorporated in Newark, N. J., to deal in automobiles, etc. Capital, $50,000. Incorporators, G. F. Brandenburg, W. Hawkins, P. F. Jones, all of Newark; B. F. Jones, attorney, South Orange.

THE AUTOMOBILE CLUB OF AMERICA.—It is stated that the next run of the Automobile Club of America will be to Philadelphia, and will probably take place the first week in April. The run will likely start from New York on Saturday. The participants will remain in Philadelphia over Sunday, returning on Monday.

FRED WARD & SONS, 48 Fremont Street, San Francisco, have taken the electromobile agency. An automobile club is about to be organized in the city. The Golden Gate Park Commissioners have just made their first concession, and now the machines are allowed to run on the drives at the south side of the park. At present the automobiles are but seldom seen in the streets, though many have been ordered.

AUTOMOBILE HILL CLIMBER.—A notable performance was made by a Sperry electric vehicle a few days ago. Mr. Whitney Lyon, of the automobile Club of America, made a test of his new electric automobile, traveling over 38 miles on one charge of the battery, including the climbing of the steep hill at Fort Lee, N. J. The vehicle weighs 2000 pounds, is of 2½-hp, and carries a battery of 40 storage cells. Mr. Lyon is very enthusiastic over his machine and its performance.

THE BUFFALO ELECTRIC VEHICLE COMPANY'S new officers, just elected, are: President and general manager, F. A. Babcock; treasurer, Isadore Michael; attorney, E. C. Randall; directors for the first year, F. A. Babcock, Isadore Michael, E. C. Randall, Theodore S. Fassett, Leonard B. Crocker, Henry C. Diehl, of Buffalo; the Hon. Jacob Amos, of Syracuse. Papers of incorporation have been filed at Albany, and work on the new shops has been commenced.

NEW INDUSTRIAL COMPANIES.

THE S. B. ALEXANDER, JR., COMPANY, dealers in electrical supplies, recently organized at Charlotte, N. C., has opened up with a capital of $25,000.

THE IDA GROVE ELECTRIC COMPANY, of Ida Grove, Iowa, has been incorporated to do an electrical business. Capital, $30,000. Incorporators, J. W. Reed, F. A. Lusk, both of Ida Grove.

THE BUFFALO ELECTRIC SURGICAL INSTRUMENT COMPANY has been incorporated to manufacture electrical appliances. Capital, $9000. Incorporators, J. C. Brecken, E. G. Lapham, C. Taylor, all of Buffalo; E. L. Falk, attorney, Buffalo.

THE C. R. FISH COMPANY has been incorporated in Portland, Me., to do a general electrical business, with a capital of $50,000. The incorporators are: H. Mulholland, J. S. Keenan, both of Boston; C. R. Fish, of Cambridge; S. C. Perry, attorney, Portland.

THE SHOENBERG ELECTRICAL COMPANY, San Francisco, was recently incorporated to construct and repair electrical appliances. Directors, A. S. Wadleigh, M. H. Shoenberg, G. A. Gott, L. Reuzer and H. Shoenberg, all of San Francisco. Capital stock, $25,000; all subscribed.

THE TAYLOR ELECTRIC SEPARATOR, CONCENTRATOR & AMALGAMATOR COMPANY was recently incorporated, with San Francisco, Cal., as the principal place of business. The directors are: J. M. Taylor, Nome, Alaska; J. T. White, F. R. Enright and W. H. Smith, San Francisco, and H. H. Hunter, San Jose. The capital stock is $50,000, all of which is subscribed.

THE UNION ELECTRIC MANUFACTURING COMPANY, of Portland, Me., has been incorporated for the purpose of manufacturing and dealing in electrical apparatus. Capital, $200,000. Incorporators, A. D. Boyd, J. K. Knapp, J. R. P. Rogers, all of South Portland; E. W. Dodge, L. F. Jordan, C. E. Bailey, E. Harlow, Jr., C. F. Long, all of Portland; B. G. Ward, attorney, Portland.

LEGAL.

RECEIVER APPOINTED.—Mr. James A. C. Johnson has been appointed receiver of the New York Electrical Works, at 515 Kent Avenue, Brooklyn Borough, New York City. The directors have petitioned for the voluntary dissolution of the corporation.

TEXAS FRANCHISE TAX.—The corporations of Texas gained a big victory in the district court at Austin last week in securing from Judge Morris an opinion throwing out of court the hundreds of franchise tax suits pending against all quasi-public corporations for taxes claimed to be due on their franchises.

TEXAS ANTI-TRUST SUITS.—The anti-trust suits instituted a few months ago by the State of Texas against the San Antonio Street Railway Company, the San Antonio Edison Company, the San Antonio Gas Company and the Mutual Electric Light Company, all of San Antonio, Texas, for forfeiture of their respective charters and appointment of receivers, have been brought to an end by an agreed judgment being entered in each case. This agreed judgment provides for the appointment of a receiver for each company, for the forfeiture of each charter, and for the sale of the property of each of the companies on April 3. The following receivers have been appointed: Thomas Johnson, receiver for the San Antonio Street Railway Company; E. R. Norton, for the San Antonio Edison Company; Ben M. Hammond, for the San Antonio Gas Company, and William G. Schuwirth, for the Mutual Electric Light Company.

PERSONAL.

MR. MORITZ H. BONINGER, of Cologne, Germany, is on a trip to this country, studying the electrical situation and making arrangements for agencies in his city.

PRESIDENT ROSSITER, of the Brooklyn Rapid Transit, has gone south for recreation. Mr. J. C. Breckenridge, as acting general manager, now takes considerable work off his hands.

MR. M. J. INSULL, vice-president and general manager of the General Incandescent Arc Light Company, is convalescing from a very severe attack of quinsy and is again at business.

MR. A. B. SHEPARD has been appointed manager of the Cleveland office of the General Electric Company, to succeed E. K. Gillette, who has been appointed office manager of the Sterling Company at Pittsburg.

DR. COLEMAN SELLERS and William A. Brackenridge, of the Niagara Falls Power Company, have returned from Geneva, Switzerland, where they went to consult eminent Swiss engineers in regard to suggested changes in the construction of the turbines that are to be installed in the new wheel-pit or the Niagara Falls Power Company.

MR. CHARLES H. SEWALL.—On the evening of March 3 a farewell dinner was given Mr. Charles H. Sewall by his associates in the office of John A. Roebling's Sons Company, of Chicago. He has resigned his position as electrical engineer and telephone expert with the Roeblings, with whom he has been connected for the past eight years, for the purpose of pushing in the east, with headquarters at New York City, a number of electrical specialties partly his own inventions and mostly in the line of telephone supplies. The dinner was given in the German Room of the Grand Pacific Hotel and was a thoroughly enjoyable affair, aside from the general feeling of regret felt by all that Mr. Sewall had decided to sever his connections with the company, where he was held in such high esteem, both personally and professionally. Those present were: H. E. Fisk, A. J. Greathead, J. T. Montgomery, F. A. Deacon, J. S. Pooley, H. A. Wright, T. C. Nash, A. M. Whaley, H. Rae, E. Hallett, A. B. Conover.

OBITUARY.

HERBERT G. GEER, a consulting electrical engineer, residing in Baltimore, died in that city on March 7, at the age of 31 years. He was a Cornell graduate, and for six years was associate professor of mechanical engineering at the Johns Hopkins University, Baltimore. At the time of his death he was engaged in the practice of his profession. He was a member of the Franklin Institute and the American Society of Mechanical Engineers.

Trade Notes.

THE CHELSEA CLOCK COMPANY, Chelsea, Mass., are manufacturing a nonmagnetic clock for switchboards, which they intend selling to the electrical trade.

THE BERLIN IRON BRIDGE COMPANY of East Berlin, Conn., have received through a large Philadelphia exporting house the contract for eleven plate girder bridges, to be sent to foreign parts.

THE ELECTRIC APPLIANCE COMPANY, Chicago, are calling attention to the fact that the storm season is upon us, and are pointing with pride to the Wurt's lightning arrester which they are selling.

THE ADAMS-BAGNALL COMPANY, Cleveland, say that although the demand for arc lights is usually rather low at this season of the year, they have a number of large contracts on hand which will keep them very busy for some time to come.

MR. J. J. REIDY, 311 East Street, New Haven, Conn., is handling the Donnelly steel pole climber, which is well known among electric wiremen and contractors. Mr. Reidy is pushing it to the front with the assurance that it is the best article of the kind that the market affords.

THE CHICAGO RHEOSTAT COMPANY, 397 East Thirty-third Street, New York, has just brought out Bulletin No. 41, which is supplementary to No. 40 and descriptive of that company's new types of automatic, underload and overload starters. Copies may be had on application.

THE WASHBURN WIRE COMPANY has been formed, with a capital stock of $1,000,000, with headquarters at Worcester, Mass. It is stated that this company will be a competitor of the American Steel and Wire Company. Peabody & Co., of Boston, have underwritten the stock of the new concern.

THE RUSSELL-TOMLINSON ELECTRIC COMPANY recently moved its plant from Shelton, Conn., to Milford, Conn. This change was rendered necessary through the healthy growth of its business and the increasing demand for its products. The company is bringing out some new goods in the telephone line.

THE BULLOCK ELECTRIC MANUFACTURING COMPANY, of Cincinnati, will go after business of the northwest, and Mr. Gilbert Donaldson, of Minneapolis, has been appointed to take charge of the territory consisting of the northwestern portion of Wisconsin, North and South Dakota, Montana, and about one-half of Iowa.

THE TRIUMPH ELECTRIC COMPANY, of Cincinnati, has issued a new catalogue with cuts and description of all the up-to-date machinery made by that enterprising firm. Mr. Jacobs, of the company, notes the sale of a power plant for a concern in Denver and a number of inquiries from that section indicating a general awakening in the west.

THE STEPHENSON MANUFACTURING COMPANY, of Albany, N. Y., are selling their belt dressing to some of the largest railroads, engine builders and manufacturers in the country. They say the usual experience is that duplicate orders follow wherever the dressing is once tried. Mr. E. A. Kellogg, of this company, was in New York last week, and reported a very satisfactory trip.

MESSRS. W. I. GRAY & CO., Minneapolis, Minn., have been awarded the contract to wire the new Arlington Building, on the corner of Nicollet Avenue and Fifth Street, Minneapolis. All wires will be pulled in iron conduit, and the best material and latest improvements used throughout. There will be 5000 incandescents and 100 enclosed arcs installed. The cost will exceed $15,000.

WILLIAM ROCHE, 42 Vesey street, New York, exhibits, under date of March 7, an order for 600 of his dry batteries, with the stipulation that same must equal the "New Standard" to be furnished the U. S. Torpedo Station, Newport, R. I. Mr. Roche reports his business as constantly increasing, and orders, both foreign and domestic, have never been so great in the history of his business.

THE LUCAS MACHINE TOOL COMPANY, recently organized, has commenced operations in the old Brush Electric Company's plant, in Cleveland, Ohio. The company will design and build machine tools and special machinery, and starts with several excellent contracts. Mr. Henry M. Lucas, for the past fifteen years with Warner & Swasey, of Cleveland, is at the head of the company.

THE BURT MANUFACTURING COMPANY, of Akron, Ohio, manufacturers of the Cross Oil Filter, have just received one of the largest orders of the year from Yokohama, Japan. This concern say they have already broken their record for business as compared with the early months of previous years. The Lehigh Valley Coal Company have just sent in an order for nine, and the American Tin Plate Company their twelfth order.

MESSRS. QUEEN & CO., of Philadelphia, manufacturers of scientific and electrical instruments, have established a branch agency at No. 480 Monon Building, Chicago. Mr. S. T. Hutton is appointed manager of same. Queen & Co. already have an agency in New York, which has been established for a number of years, and no doubt their Chicago office will prove as profitable as their New York office has in the past.

THE WESTERN ELECTRICAL SUPPLY COMPANY, of St. Louis, have recently added to their already large telephone department a number of new specialties. They call particular attention to their new (Bell) pattern improved

nickel-plated desk set, which they claim is the most compact and handsomest desk set ever produced. They have a large amount of printed matter covering their telephone and switchboard accessories, which they mail on application.

THE BROWNING MANUFACTURING COMPANY, Milwaukee, Wis., manufacturers of electrical specialties for dental work, has made many valuable improvements in this line. Its latest achievement is the Watson Rotary, which is a rotary transformer for charging storage batteries from alternating current. The company has always enjoyed a big business, and is now far behind in its orders. Mr. Thomas S. Watson is the electrical and mechanical engineer.

MR. RODOLPHUS FULLER, secretary and manager of the Fuller Company, Detroit, Mich., was in Chicago last week, after having made an extensive tour of the West and Northwest, inspecting his different agencies. Mr. Fuller reports most favorably on the demand for his electrical and ventilating apparatus. In fact, the demand for his fan has been so great that it has necessitated doubling the capacity of his factory, which is now running night and day.

THE GUARANTEE ELECTRIC COMPANY, Chicago, has just moved into a large new fireproof building, located at 133-139 South Clinton Street. The store has a fine front, giving the company one of the finest dynamo show rooms in the city. The company's repair shop has been equipped at an expense of $20,000. It is now doing a very large business, and with Mr. Charles E. Gregory, its enterprising president, at the head, it ought to set the pace in the electrical field.

THE AMERICAN ELECTRIC TELEPHONE COMPANY, Chicago, state that their friends are congratulating them upon the successful issue in the Carty bridging bell suit. This suit was brought against the Anthracite Telephone Company using apparatus furnished by the American Electric Telephone Company, and the decision, they say, sustains their claims in regard to furnishing non-infringing apparatus and of protecting their customers in the use of the same.

"G-I" BULLETINS Nos. 53, 54 and 80 have just been issued. No. 53 illustrates and describes the new automatic switch, No. 54 the new flush push switch, and No. 80 is an instruction sheet on the alternating current enclosed arc lamps. We are also in receipt of the catalogue on Paragon fans for 1900—a tasteful booklet with prices and descriptions of the various types of fans. A postal will bring the lot if addressed to the General Incandescent Arc Light Company, 572 First Avenue, New York City.

THE SPRAGUE ELECTRIC COMPANY has just issued a handsome catalogue of 148 pages of its iron-armored, brass-armored, unarmored and flexible metallic interior conduit, insulated fittings, boxes, elbows, switches, cut-outs, special tools, etc., etc. The different types of conduit and the devices used in their installation are very completely illustrated. The catalogue in general is an excellent piece of work and corresponds with the other trade productions of this company, which are well known for their high standard.

THE NEW ENGLAND MOTOR COMPANY and the Bullock Electric Company have completed arrangements by which the latter company secures the exclusive agency for the type E (bipolar), type ME (multipolar) universal motors and type F slow speed motors and generators, recently brought out by the New England Motor Company, of Lowell, Mass. This does not include types B and D. A considerable addition has been made to the force, and the factory enlarged, which will enable them to take care of their rapidly increasing business.

THE RELIANCE MANUFACTURING COMPANY, Cleveland, manufacturers of steam separators, steam traps, exhaust pipe heads, safety water columns, etc., has changed its name to the Wright Manufacturing Company. The change is the outcome of a law suit between the Reliance Gauge Column Company, of Cleveland, and the company mentioned. The defendant was enjoined from the use of the word "Reliance," either in its products or in its corporate name, and in return the plaintiff relinquished all claims for infringement on its patents, now pending in the Federal Court.

I. P. FRINK reports a number of installations of Frink's patent store window reflector, the most important being in the new Gross & Strauss store, at Bedford and Washington Streets, the addition of R. H. White & Co., and the store of B. Summers & Co., on Winter Street, Boston. He has also just completed the installation of his special patent window reflectors in the Warren Street store of Rogers, Peet & Co., New York, built to replace the old one destroyed by fire. These reflectors were some time ago installed in their Thirty-third Street store, and as "once used, always used," is the rule with these window reflectors, it is only natural that they should have been put in the new store.

LIGHTING A CLEVELAND STORE FRONT.—An unusual departure in the way of show window advertising is that of the May Company, in Cleveland. They have probably the most remarkable store front in the world. They have utilized the plate glass front of their building, the whole six stories in height, and have lighted this enormous expanse of window display with Frink's special patent window reflectors, which had been previously used in the stores of this syndicate in St. Louis and Denver. Quite a number of Cleveland stores owe their attractive show windows to this system of lighting, among them being Kent, Hoyt & Sefton Company, Browning, King & Co., J. G. Meckes, Fries & Schuele, and Nathan Skall.

THE EMERSON ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., announce that their special distributing agents have received their stocks of Emerson 1900 model fan motors and ceiling fans, and that prompt shipments of Emerson latest model motors can be made by the Western Electrical Supply Company, of St. Louis, Mo.; the California Electrical Works, of San Francisco, Cal., and the H. C. Roberts Electric Supply Company, of Philadelphia, Pa. In addition to these special distributing agents, the Emerson Company have a branch office and warehouse at 136 Liberty Street, New York City, and within ten days or two weeks, will be in a position to make prompt shipments of motors from New York City. The special distributing agents mentioned are in a position to name exactly the same prices as named by the factory.

THE COLONIAL ELECTRIC COMPANY, of Youngstown, O., has combined with the Orient Electric Company of the same place, and the combination will be known hereafter as the Colonial Electric Company. The combined plants will be moved to Ravenna, O., where favorable inducements have been made to bring the establishment to that place. The new factory is a large four-story brick building, the second largest in the city. It will be equipped with the most modern machinery and appliances for the manufacture of incandescent lamps. The combined output of the two merged factories, Manager J. B. Estabrook of the Colonial Company states, will be more than that of any other of the "independent" factories. Mr. F. E. Kirschner, superintendent in the new company, has had ten years experience in that capacity in prominent lamp factories throughout the country. Forty or fifty employees and heads of departments will be taken to Ravenna from Youngstown, and it is expected that when the new establishment is in full running order two hundred hands will be employed.

TO PROTECT PATENTEES.—While the United States government issues patents on new inventions, etc., it does not protect the patentee against piracy or infringement. To obtain protection against such lawlessness the patentee is compelled to appeal to the courts, which, usually, is a very costly method to defend one's rights, and inventors of small means frequently lose the fruits of their genius and skill on account of their financial inability to secure justice through the courts. The Patent Title & Guarantee Company has been organized in New York City for the purpose of defending inventors of their rights and secure for its clients every right to which they are legally entitled. It has large resources, both as to capital and brains, and as there has long existed a demand for such help and protection as this company affords, its business will likely prosper. The company's headquarters are at 27 William Street, New York, and among its directors are Hon. James E. Campbell, ex-governor of Ohio; Stilson Hutchins, of Washington; Harry Keene, president Kern Incandescent Gas Light Company, New York, and other well known business men and capitalists. Mr. I. Katzenberger is president; John M. Billings, secretary and general manager, and W. Newton Bennington, treasurer.

Record of Electrical Patents.

UNITED STATES PATENTS, ISSUED MARCH 6, 1900.

[Conducted by William A. Rosenbaum, Patent Attorney, Times Bldg., N. Y.]

644,562. ELECTRIC ARC LAMP; T. E. Adams, Cleveland, Ohio. App. filed Aug. 16, 1899. An enclosed arc lamp wherein the improvements reside in the mounting of the inductive resistance, in the clutch mechanism and in the general details of construction.

644,563. ELECTRIC ARC LAMP; T. E. Adams, Cleveland, Ohio. App. filed Sept. 20, 1899. Details of construction.

644,565. TRANSFORMER; E. Arnold, Carlsruhe, Germany. App. filed Dec. 23, 1898. A transformer of rotating currents having three iron cores connected by a yoke in three sections, the ends of two sections of the yoke being magnetically connected to each core, and two cores being connected by each section. The object is to perform a given amount of work with a minimum of weight.

644,594. TELEPHONE SYSTEM; J. W. Gore, Chapel Hill, N. C. App. filed Aug. 16, 1899. (See Current News and Notes.)

644,639. ELECTRIC RAILWAY SIGNAL; J. Shoecraft, Topeka, Kan. App. filed April 8, 1899. The invention contemplates a new type of relay having a novel form of armature co-operating with a peculiarly constructed arm which not only acts in the capacity of a contact, but also in connection with another contact serves to lock the apparatus out of operation as soon as a train has passed a crossing.

644,646. INSULATOR FOR USE ON ELECTRIC RAILWAYS; J. and W. R. Thomas, Catasauqua, Pa. App. filed Dec. 12, 1899. The device comprises a base, an insulating block having a recess adapted to fit upon a projecting portion of the base and a conductor supporting cup fitting upon and enclosing the other portion of the block.

644,647. SELECTIVE SIGNAL FOR TELEPHONE CIRCUITS; G. K. Thompson, Malden, Mass., and E. C. Robes, Medford, Mass. App. filed July 18, 1899. (See Current News and Notes.)

644,652. TELEPHONE TRANSMITTER; J. M. Wilderman and E. A. Nelson, St. Charles, Mo. App. filed Aug. 24, 1899. (See Current News and Notes.)

644,658. CIGAR LIGHTER; C. B. and S. Abbott, Cleveland, Ohio. App. filed Jan. 27, 1899. The invention here is of a mechanical nature and consists principally of means for extinguishing the torch after it has been electrically ignited.

644,666. CONTROLLER FOR ELECTRIC MOTORS; M. W. Day, Schenectady, N. Y. App. filed Dec. 17, 1898. (See Current News and Notes.)

644,671. ELECTRIC MOTOR CAR; C. M. Johnson, New York, N. Y. App. filed Aug. 8, 1898. The vehicle carries a storage battery, a dynamo and a motor having two armature circuits. The dynamo feeds one armature circuit and the battery feeds the other. One or both may be used at pleasure.

644,680. TELEPHONE GUARD; L. B. Ordway, San Francisco, Cal. App. filed Dec. 12, 1898. This is a disk of celluloid adapted to be placed across the front of the mouthpiece and held in place by a curved edge engaging with the edge of the mouthpiece.

644,684. DYNAMO ELECTRIC MACHINE; H. G. Reist, Schenectady, N. Y. App. filed Oct. 27, 1899. A current collecting device for a dynamo having at its sides annular barriers of insulating material rising above the plane of the brush contacts and formed of a plurality of independent segments.

644,714. TELEGRAPH SOUNDER; S. F. Lively, Olderson, W. Va. App. filed June 6, 1899. Details of construction whereby the tone or pitch of a double sounder will be the same at both ends.

644,716. ELECTRIC CAR BRAKE; U. E. Maille, Providence, R. I. App. filed July 7, 1899. A friction cone surface works in a conical socket formed in the pinion on the motor shaft. Mechanical contrivances are provided for throwing the frictional surfaces into and out of contact.

644,745. ELECTRIC SWITCH; N. Marshall, Newton, Mass. App. filed April 25, 1899. Details of construction of a snap switch.

644,779. PROCESS OF MANUFACTURING METALLIC CARBONATES BY ELECTROLYSIS; J. W. Richards and C. W. Roepper, Bethlehem, Pa. App. filed July 6, 1897. (See Current News and Notes.)

644,783. ELECTRIC GLOW LAMP; J. Van Vleck, New York, N. Y. App. filed May 9, 1899. (See Current News and Notes.)

644,784. ELECTRIC GLOW LAMP; J. Van Vleck and W. N. Stevens, New York, N. Y. App. filed June 8, 1899. (See Current News and Notes.)

644,785. ELECTRIC GLOW LAMP; J. Van Vleck, New York, N. Y. App. filed June 8, 1899. (See Current News and Notes.)

644,790. RAILWAY SIGNALING SYSTEM AND APPARATUS THEREFOR; H. Bezer, New Rochelle, N. Y. App. filed July 22, 1893. The invention has to do principally with the relay, which consists of two opposing coils arranged in series in a normally closed circuit, an armature between the coils and means for actuating the armature by shunting one of the coils.

644,791. TOOLS FOR LAYING CONDUITS FOR ELECTRICAL CONDUCTORS; J. F. Cummings, Detroit, Mich. App. filed July 22, 1899. The tool consists of a central stem surrounded by a helix and is intended to be pulled through the conduit to align the sections.

644,823. ELECTRIC LAMP FOR BICYCLES; G. Heidel, St. Louis. App. filed Jan. 9, 1899. A frame mounted on the head of the bicycle carries a friction pulley engaging the front wheel, a small dynamo, a lamp and a reflector.

644,844. ELECTRIC SWITCHBOARD; J. H. Bunnell, deceased, New York, N. Y. App. filed Nov. 18, 1899. The improvement consists in providing the plugs with springs which exert a lateral pressure in such a manner as to cause the plugs to bear frictionally and laterally against the interconnected bars.

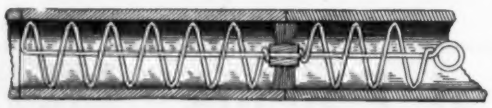
644,850. FUSE BLOCK; H. P. Davis, Pittsburg, Pa. App. filed Jan. 30,. 1899. (See Current News and Notes.)

644,852. ELECTRIC PUMP; C. Eickemeyer, Yonkers, N. Y. App. filed July 27, 1899. The motor is controlled by a hydraulic regulating device, which is connected by a pipe with the delivery chamber of the pump, the pipe directly transmitting the fluid pressure in the delivery chamber to the regulating device for the automatic regulation thereof.

644,858. MEANS FOR GIVING RIGIDITY TO ELBOWS OR TURNS OF FLEXIBLE CONDUITS; E. T. Greenfield, New York, N. Y. App. filed Dec. 18, 1899. A rigid bracket adapted to be applied to the conduit at a bend therein to hold it in shape.

644,859. ELECTRICAL MEASURING INSTRUMENT; A. H. Hoyt, Penacook, N. H. App. filed Sept. 22, 1899. (See Current News and Notes.)

644,860. ELECTRIC GAS LIGHTER; C. Hubert, New York, N. Y. App. filed March 6, 1899. The apparatus is portable and provided with a lamp and a lighting device, either of which may be energized by a battery located in the handle. The lamp is lighted to show where the gas valve is located, after which the lamp is cut out and the igniter used to light the gas.



644,794.—Tool for Laying Conduits for Electrical Conductors.

644,864. ELECTROMOTIVE FORCE REGULATION; B. G. Lamme, Pittsburg, Pa. App. filed Oct. 6, 1898. (See Current News and Notes.)

644,865. SYSTEM OF ELECTRICAL DISTRIBUTION; B. G. Lamme, Pittsburg, Pa. App. filed June 14, 1899. (See Current News and Notes.)

644,868. TELEPHONE SIGNAL CIRCUIT; D. McNeil, Chadron, Neb. App. filed July 12, 1899. The improvements relate to party lines and consist in means whereby all bells will be sounded from any distant station and whereby a minimum portion of the current of the magneto is employed for operating the home bell while the larger portion is used to overcome the intervening resistance and for operating the distant bells.

644,878. AUTOMATIC CIRCUIT BREAKER; D. W. Stinson, St. Louis, Mo. App. filed July 3, 1899. A lighting or power circuit arranged with a generator for supplying the circuits with alternating currents, a switch and means whereby the switch is actuated when the current or electromotive force in the circuit is at the zero point of any alternation.

644,917. ELECTRICAL MEASURING INSTRUMENT; A. H. Hoyt, Penacook, N. H. App. filed Sept. 22, 1899. (See Current News and Notes.)

644,921. WIRE HANGER; J. W. L. Jaques, Salt Lake City, Utah. App. filed Nov. 27, 1899. The hanger comprises a casing open at its top and ends, clamping blocks movable in opposite directions in the casing for engaging with the wire and a wedge block for moving the first named block outward.

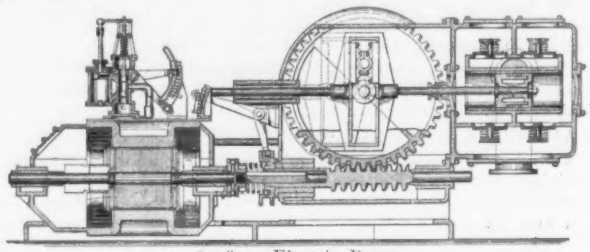
644,962. ELECTRIC ARC LAMP; E. M. Barnes, Cleveland, Ohio. App. filed April 10, 1899. A pair of magnets is arranged on opposite sides of a central tube and an armature plate surrounds and slides upon the tube. To the plate are attached rods supporting the lower carbon and for actuating the clutch.

644,972. INDUCTION COIL FOR X-RAY APPARATUS; R. A. Fessenden, Allegheny, Pa. App. filed March 19, 1897. (See Current News and Notes.)

644,995. VACUUM TUBE LIGHTING; D. McF. Moore, Newark, N. J. App. filed Nov. 9, 1899. The alternating current generator used in this system is designed to produce alternations which abruptly change in value.

645,007. PROTECTIVE SYSTEM AND APPARATUS FOR HIGH TENSION ELECTRIC CURRENTS; L. C. Reed, New Orleans, La. App. filed July 17, 1899. (See Current News and Notes.)

645,008. PROTECTIVE SYSTEM OF ELECTRICAL DISTRIBUTION; L. C. Reed, New Orleans, La. App. filed July 17, 1899. (See Current News and Notes.)



644,852.—Electric Pump.

645,009. SYSTEM OF ELECTRICAL DISTRIBUTION; L. C. Reed, New Orleans, La. App. filed July 17, 1899. (See Current News and Notes.)

645,010. ELECTRIC CIRCUIT BREAKER; L. C. Reed, New Orleans, La. App. filed Aug. 5, 1899. (See Current News and Notes.)

645,011. UNDERGROUND SYSTEM OF ELECTRICAL DISTRIBUTION; W. B. and L. C. Reed, New Orleans, La. App. filed Aug. 21, 1899. (See Current News and Notes.)

645,012. SYSTEM OF OVERHEAD ELECTRICAL DISTRIBUTION; W. B. and L. C. Reed, New Orleans, La. App. filed Sept. 13, 1899. (See Current News and Notes.)

645,013. SERIES ARC SYSTEM OF ELECTRICAL DISTRIBUTION; W. B. and L. C. Reed, New Orleans, La. App. filed Sept. 15, 1899. (See Current News and Notes.)

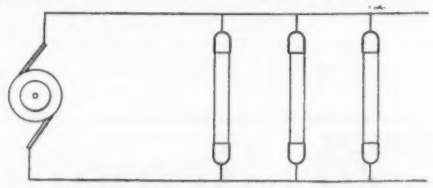
645,014. SYSTEM OF ELECTRICAL DISTRIBUTION; W. B. and L. C. Reed, New Orleans, La. App. filed Oct. 6, 1899. (See Current News and Notes.)

645,015. ELECTRIC RAILWAY; W. B. and L. C. Reed, New Orleans, La. App. filed Oct. 16, 1899. (See Current News and Notes.)

645,020. THIRD RAIL ELECTRIC RAILWAY; D. C. Seaton, St. Louis, Mo. App. filed Sept. 18, 1899. A guard and a shield extend alongside the third rail to protect an insulator.

645,021. UNDERGROUND ELECTRIC RAILWAY; G. W. Smith, Dallas, Texas. App. filed Aug. 23, 1899. The collecting device is in the form of a trolley and is surrounded on all sides by brushes which remove obstructions from the surface of the conductor.

645,041. VACUUM TUBE LIGHTING; D. McF. Moore, Newark, N. J. App. filed July 27, 1899. This consists in the direct combination of the vacuum tube and source of alternating current connected directly to the caps or terminals of the tube and exciting the latter to luminosity by the continuous application of the alternating electromotive forces produced by the generator, the illumination being produced without the breaking of any circuit, either direct or alternating.



645,041.—Vacuum Tube Lighting.

GERMAN PATENTS, ISSUED FEB. 21, 1900.

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106,447. METAL-DUST RESISTANCE. F. R. Dietze, Coswig. App. filed Feb. 8, 1899. This is a modification of the well-known resistances in which an arm connected to one of the terminals is dipped to greater or lesser depth into metal dust, which is in contact with the second terminal. The essence of the invention is a second lever arm on the same pivot with the main lever arm, which does not dip into the metal dust, but makes contact only with the connecting piece for the metal dust before the main arm enters the same and disconnects from said metal piece after the main arm has left the metal dust.

106,676. MANHOLE CHAMBER. Jacob Cloos, Milwaukee. App. filed Oct. 5, 1897. The several branches of electric cables are connected to divided horizontal connecting plates, into the holes of which suitable plugs are inserted to make connection.

107,097. DRY BATTERY. Eugen Folkmar, Berlin. App. filed April 30, 1899. The cylindrical zinc-electrode forming the vessel for the dry-battery is surrounded by a second metallic mantle and separated from the same by some insulating material. The latter forms the dielectric of a condenser, the outer and the inner metallic layer of the condenser being formed by the metallic mantle and the zinc-electrode.

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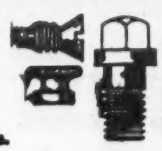

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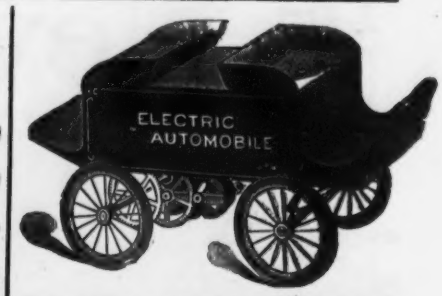

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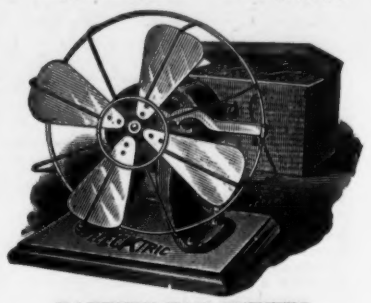

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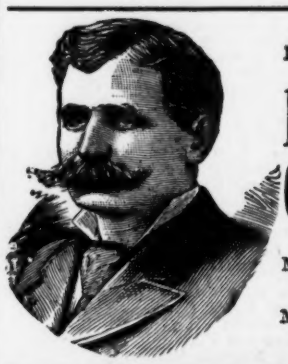

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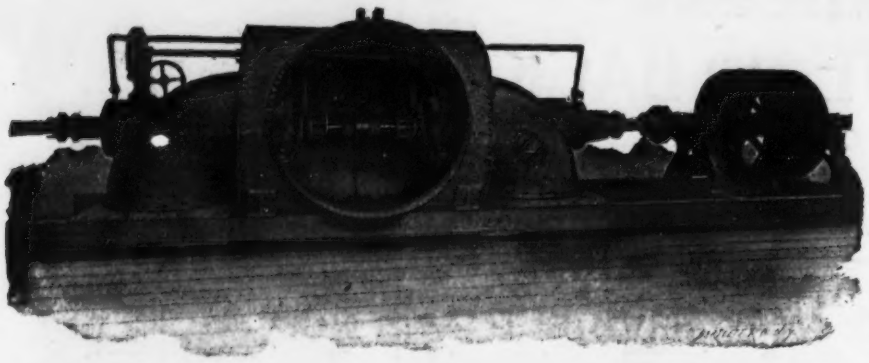

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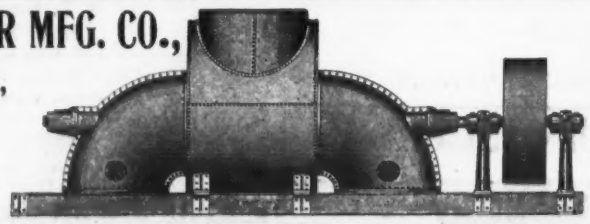

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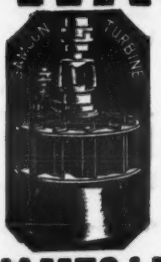

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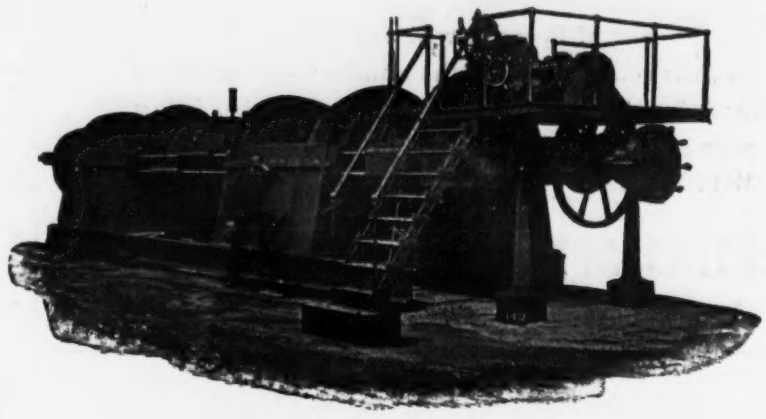

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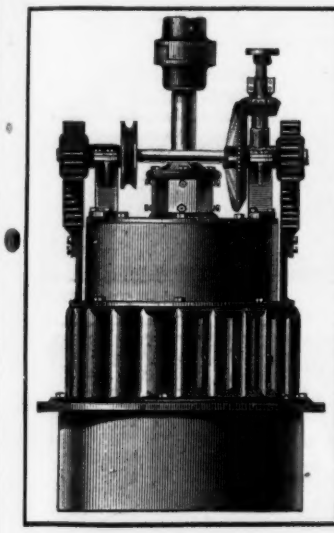

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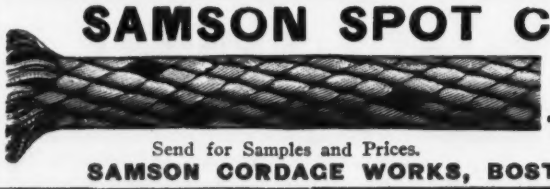

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